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**RESEARCH NATURAL AREA PROGRAM
ANNUAL REPORT**

**USDA FOREST SERVICE
ROCKY MOUNTAIN REGION
AND
ROCKY MOUNTAIN EXPERIMENT STATION**

JULY 1995

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AND
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TABLE OF CONTENTS

Summary	1
Research Natural Areas	2
Research Natural Area Committee	2
Proposed RNAs in Forest Plan Revisions	2
RNA Designations in Progress	4
Potential RNAs on other National Forests	4
RNA Analysis	5
National Grasslands RNA Analysis	6
RNA Research	6
Rocky Mountain Station General Technical Report	7
Descriptions of Proposed RNAs	7
Arapaho and Roosevelt National Forests	7
Pawnee National Grassland	9
Routt National Forest	11
Rio Grande National Forest	13
Representation Analysis for RNAs	20
Research Appendix	43

Figures

1. Proposed RNAs	17
2. Established RNAs	18
3. Ecoregions and Subregions (Sections)	19

Tables

1. Northern Parks and Ranges Section, M331I	26
2. South-Central Highlands Section, M331G and Southern Parks and Rocky Mountain Ranges Section, M331F	34
3. North-Central Highlands and Rocky Mountain Section, M331H	41

**ANNUAL REPORT TO THE REGIONAL FORESTER AND STATION DIRECTOR
ON THE RESEARCH NATURAL AREA PROGRAM**

**ROCKY MOUNTAIN REGION AND EXPERIMENT STATION
USDA FOREST SERVICE**

JULY 1995

prepared by Tom Andrews and Mike Ryan for the RNA Committee
in accordance with FSM 4063.5, R-2 Supplement No. 1

SUMMARY

The Rocky Mountain Region and Rocky Mountain Experiment Station have made significant steps toward a goal of expanding their system of Research Natural Areas. Twenty three sites totalling approximately 170,000 acres will be proposed as RNAs in the Plan Revision Draft EISs for the Rio Grande, Routt, and Arapaho and Roosevelt National Forests and Pawnee National Grassland. These proposed RNAs have all received Ecological Evaluations through cost-share agreements with non-Forest Service partners. In addition, Environmental Assessments will be completed for the proposed Daves Draw, Hoosier Ridge, and Tabaguache RNAs. A representation assessment of these 26 proposed RNAs by ecoregion indicates that they would make an excellent start in representing the ecological variability of National Forest System land within the Rocky Mountain Region.

Ecological Evaluations have been completed for 13 potential RNAs on the Medicine Bow National Forest and three on the Shoshone National Forest. An RNA analysis process has begun on the White River, San Juan, and Grand Mesa, Uncompahgre and Gunnison National Forests. Potential RNA sites on these Forests have been identified and cost-share agreements signed to have Ecological Evaluations performed during the summer of 1995. The eight National Grasslands in Nebraska, Wyoming, and North and South Dakota will begin an RNA assessment process this year under the Plan Revision umbrella of the Nebraska National Forest.

The RNA program funded a research study of bristlecone pine ecosystem variability that will be a useful model for assessing ecosystem representation in the RNA system. Additional research has been performed on a number of established, proposed, and potential RNAs in the Region. The Experiment Station published a General Technical Report on RNAs.

RESEARCH NATURAL AREAS

The Rocky Mountain Region and Rocky Mountain Experiment Station recognize the need for an expanded system of Research Natural Areas (RNAs) to better represent the ecological variability of National Forest System land within the Region. RNAs are important tools for ecosystem management and research. They provide references or benchmarks for evaluating the success of management of similar lands, protection for a wide range of biodiversity, and sites for scientific investigation of ecosystem composition, structure, and function.

RESEARCH NATURAL AREA COMMITTEE

The Research Natural Area Committee for the Rocky Mountain Region and Experiment Station includes the following individuals:

Craig Whittekiend - Director, Renewable Resources
Dave Anderson - Director, Planning and Program Budget
Charlie Richmond - R2 RNA Coordinator
Mike Ryan - RM RNA Coordinator

The RNA Committee meets at least annually to review RNA proposals and attend to RNA program business. The Research Natural Area ecologist, Tom Andrews, provides information and technical assistance to the RNA Committee.

PROPOSED RNAS IN FOREST PLAN REVISIONS

During the summer and fall of 1995, Draft EISs for Revisions of the Land and Resource Management Plans will be printed for the Rio Grande, Routt, and Arapaho and Roosevelt National Forests. In 1993 and 1994 these Forests began an analysis to identify potential RNAs. Challenge Cost-Share Agreements with the Colorado Natural Areas Program and the Colorado Natural Heritage Program were developed in 1994 to complete Ecological Evaluations of potential RNAs identified in the analyses.

As a result of these analyses, and using the information provided in the Ecological Evaluations, the Forests decided to include the following proposed RNAs in some of the Alternatives in their Plan Revisions. Descriptions of these proposed RNAs are found beginning on page 7.

Arapaho and Roosevelt National Forests

Lone Pine	Redfeather RD	4,558 acres
Boston Peak Fen	Redfeather RD	550 acres
Pennock Creek	Estes-Poudre RD	7,322 acres
West Creek	Estes-Poudre RD	3,753 acres
Sheep Creek	Estes-Poudre RD	1,228 acres
North St. Vrain	Boulder RD	4,793 acres
Hell Canyon	Sulphur RD	18,312 acres
Bowen Gulch	Sulphur RD	10,126 acres
Keota	Pawnee NG	827 acres
Little Owl Creek	Pawnee NG	1,108 acres
Indian Caves	Pawnee NG	<u>532 acres</u>
		53,109 acres - total

Routt National Forest

Kettle Lakes	North Park RD	6,790 acres
Arapaho Ridge*	North Park RD	13,835 acres
Silver Creek	Yampa RD	12,520 acres
Mad Creek	Hahns Peak RD	19,420 acres
Williams Fork	Middle Park RD	<u>22,380 acres</u>
		74,945 acres - total

Rio Grande National Forest

Mill Creek	Saguache RD	2,554 acres
Deadman Creek	Saguache RD	4,779 acres
North Zapata	Conejos RD	6,114 acres
Hot Creek	Conejos RD	1,773 acres
Spring Branch	Del Norte RD	4,052 acres
Little Squaw Creek	Creede RD	20,101 acres
Finger Mesa	Creede RD	<u>3,406 acres</u>
		42,782 acres - total
		170,836 acres - total

The Region and Station continue to work with the National Forests on environmental analysis of these proposed RNAs, development of RNA descriptions, information for the Draft EISs and Management Area Prescriptions, and providing detailed ecological evaluations of potential RNAs.

* The Routt National Forest has decided to substitute the Never Summer proposed RNA for the Arapaho Ridge proposed RNA.

RNA DESIGNATIONS IN PROGRESS

Most new RNAs in the Rocky Mountain Region will be identified and designated through the Revision of Land and Resource Management Plans. However, Environmental Assessments are being completed for several potential RNAs that were proposed in past years.

**1. Daves Draw - Arapaho and Roosevelt National Forests
Pawnee National Grassland**

Establishment Record completed.
Environmental Assessment completed.
Thirty day public comment period completed.
Decision Notice and replies to comments being completed.

**2. Hoosier Ridge - Pike National Forest, South Park RD
White River National Forest, Dillon RD**

Establishment Record completed.
Mineral Withdrawal proposal submitted. Segregation period in effect.
Environmental Assessment completed.
Thirty day public comment period in progress.

**3. Tabaguache - Grand Mesa, Uncompahgre, and Gunnison National Forests
Norwood RD**

Because the area burned in 1994, new field assessment work may be necessary during the summer of 1995. Environmental Assessment work will probably begin on the District during the winter of 1995/96.

POTENTIAL RNAs ON OTHER NATIONAL FORESTS

Medicine Bow National Forest

In addition to the three revision Forests mentioned above, the Medicine Bow National Forest began its RNA analysis work in 1994. The Forest developed a Challenge Cost-Share Agreement with the Wyoming Natural Diversity Data Base to complete Ecological Evaluations of potential RNAs during the summer of 1994. Thirteen potential RNA sites were evaluated. These areas and possibly others that have yet to be evaluated will receive further analysis during the Plan Revision process.

Shoshone National Forest

The Shoshone National Forest also used a Challenge Cost-Share Agreement with the Wyoming Natural Diversity Data Base to complete Ecological Evaluations of 3 potential RNA sites. These sites will be considered further during the RNA analysis process which will begin during FY 1996.

RNA ANALYSIS

White River, San Juan, and Grand Mesa, Uncompahgre, and Gunnison National Forests

Three National Forests began RNA analysis during the spring of 1995: the White River, San Juan, and Grand Mesa, Uncompahgre and Gunnison (GMUG). These Forests developed RNA ID teams and began a needs and opportunities assessment for potential RNAs.

The needs assessment asked the question, how is a system of RNAs selected that represents the major forms of ecological variability found on the National Forests: including ecosystem types (e.g., alpine, aspen, spruce-fir, Gambel's oak, subalpine grasslands); geographical differences such as variation among mountain ranges; and broad differences in geology and landforms (e.g., igneous versus sedimentary rock, glaciated high mountains versus rolling uplands). The needs assessment work is also being done on an ecoregion basis, using the Section level of Bailey's ecoregion map. Cover-type maps, geology maps, and detailed topographic quadrangles were used in these analyses. Populations of Threatened, Endangered and Sensitive species and rare community types were also considered for potential RNA targeting.

The opportunities assessment sought to minimize potential conflicts with existing commodity and amenity uses of the Forest. This approach is also useful in identifying the areas least altered by human use. Most areas were selected from vacant and closed grazing allotments, roadless areas, unsuitable timber lands, areas not leased for oil and gas or having high mineral potential, and areas not receiving high recreational use. The opportunities assessment significantly narrowed the map of available areas that could be considered in the needs assessment. By considering both ecological needs and management opportunities, a number of potential RNAs were identified for further evaluation. GIS maps were very useful in this process. Meetings have been held between the Supervisors Offices and many of the Ranger Districts on these Forests to gather additional information and solicit District involvement in the selection of potential RNAs. Areas were both dropped and added to the potential RNA list as a result of District meetings. These Forests decided that their Plan Revision schedules allowed two years of initial analysis, so the list of potential RNAs was divided roughly in half; the first half is scheduled for ecological evaluations during the summer of 1995. It is anticipated

that future public involvement will bring to light other potential RNAs worthy of consideration.

The White River National Forest is signed a \$20,000 Challenge Cost-Share Agreement (CCSA) with the Colorado Natural Heritage Program to complete Ecological Evaluations on 13 potential RNA sites during the summer of 1995. The San Juan and GMUG National Forests signed CCSAs with the Colorado Natural Areas Program for Ecological Evaluations on 10 and 12 potential RNA sites respectively. As part of the San Juan and Rio Grande CCSA, the Rio Grande National Forest will have additional field data gathered for some of its proposed RNAs. The San Juan and Rio Grande agreement is for \$34,000 and the GMUG agreement is for \$20,000.

NATIONAL GRASSLANDS RNA ANALYSIS

The eight National Grasslands of Wyoming, Nebraska, South Dakota and North Dakota have started a collective effort to revise their Land and Resource Management Plan under the umbrella of the Nebraska National Forest. Initial discussions have occurred recognizing the need and opportunity for evaluating the representation of grassland ecosystems within the RNA system. The ID Team for the Plan Revision will be taking the lead in organizing an RNA analysis effort for the National Grasslands. It is probable that a Challenge Cost-Share Agreement with The Nature Conservancy will be made to perform ecological evaluations of potential RNA sites during the summer of 1996.

RNA RESEARCH

Bristlecone Pine Ecosystems

The Station and Region RNA Program and The Nature Conservancy funded a pilot research project on bristlecone pine ecosystems in the Rocky Mountains during 1994 for \$13,400. Dr. William Baker of the University of Wyoming was contracted through the Colorado Natural Heritage Program for the work. He funded a graduate student, Brigitte Ranne, to complete the research for her Masters thesis. The final report and thesis have been received. The research determined the range of natural variability along the important environmental gradients over which bristlecone pine forests occur. Direct and indirect gradient analysis were used to determine the environmental factors influencing community composition. The principal factors were elevation, soil pH, geologic substrate, soil texture, topographic position, and geographic location, with the first two being the most important. From analysis of plot data on understory species in 49 bristlecone pine stands, a new classification of bristlecone pine plant associations was developed. All the sites were evaluated and ranked with respect to their RNA suitability. Ten of the highest quality sites were recommended as potential RNAs. These ten sites were chosen so that collectively they would adequately represent the

different plant associations and the range of natural variation found in bristlecone pine ecosystems. This research appears to provide a good model for use in designing a representative RNA system.

Additional summaries of recent research on established, proposed, and potential Research Natural Areas are found in the Research Appendix.

ROCKY MOUNTAIN STATION GENERAL TECHNICAL REPORT

In September 1994, the Rocky Mountain Forest and Range Experiment Station published General Technical Report RM-251, "Research Natural Areas in Colorado, Nebraska, North Dakota, South Dakota, and Parts of Wyoming". This report provides detailed descriptions of all the established RNAs in the Rocky Mountain Region and that part of the Northern Region administered by the Rocky Mountain Station. The report was authored by Mike Ryan, Linda Joyce, Tom Andrews, and Kate Jones.

DESCRIPTIONS OF PROPOSED RESEARCH NATURAL AREAS

ARAPAHO AND ROOSEVELT NATIONAL FORESTS

Hell Canyon Proposed RNA

This 18,312-acre area is located on the Sulphur Ranger District west of the Continental Divide within the Indian Peaks Wilderness. The area is bounded on the north by Rocky Mountain National Park and is adjacent to the Paradise Park Research Natural Area within the National Park. These two areas would enhance each other's values and provide an opportunity for interagency cooperation in management, research, data-gathering, and monitoring. The area includes 27 ponds and lakes and the complete watersheds of six small creeks. The diversity of ecosystem types is very extensive, including good representation of lodgepole pine and Engelmann spruce/subalpine fir forests and subalpine grasslands. The forests occur over a broad range of elevations, slopes, aspects, and successional stages. Areas of alpine tundra, sagebrush-bitterbrush shrublands, and montane, subalpine and alpine wetlands are also found at this site. Pleistocene glaciation has produced a landscape of peaks, high elevation cirques, and U-shaped canyon bottoms typical of the Front Range in Colorado.

Bowen Gulch Proposed RNA

This 10,126-acre area is located on the Sulphur Ranger District west of the Continental Divide near the southern end of the Never Summer Mountains. The area is contained within portions of the Never Summer Wilderness and the Bowen Gulch Protection Area and includes the complete watershed of Bowen Gulch. This proposed RNA contains one of the largest and most outstanding areas of old-growth Engelmann spruce/subalpine fir forest in Colorado. Smaller areas of lodgepole pine forest and alpine tundra are also found within the site.

Boston Peak Fen Proposed RNA

This 550-acre area is located on the Redfeather Ranger District in the upper Laramie River valley. The site contains a unique wetland ecosystem supporting outstanding examples of rare plant populations and unusual fen and willow carr plant communities. The wetland is also noteworthy for its deep deposits of peat and lake sediments. The complete watershed of this wetland is contained within the proposed RNA and is primarily lodgepole pine forest with small areas of limber pine and aspen.

Lone Pine Proposed RNA

This 4,558-acre area is located on the Redfeather Ranger District and borders the western boundary of the Lone Pine State Wildlife Area. This site includes a large trailless area of low-elevation ponderosa pine and Douglas-fir forests in gently rolling terrain. There are also several small canyons and excellent examples of Parry's oat-grass montane meadows. The site would also offer added protection to an extensive occurrence of a USDA Forest Service Sensitive Species, the endemic plant Potentilla effusa var. rupincola.

Pennock Creek Proposed RNA

This 7,322-acre area is located on the Estes-Poudre Ranger District and borders the northern boundary of Rocky Mountain National Park. This site provides a good representation for high elevation limber pine forest. The north-facing drainage basin of this site includes the complete watershed of Pennock Creek and contains one of the larger examples of Engelmann spruce/subalpine fir forest east of the Continental Divide in Colorado. Much of this spruce-fir forest is old-growth. Most of this area is located in the Comanche Peak Wilderness.

Sheep Creek Proposed RNA

This 1,228-acre area is located on the Estes-Poudre Ranger District approximately twelve miles west of Fort Collins. This area is notable for its dense riparian vegetation along a perennial stream in a foothills canyon of the Front Range. A variety of eastern woodland relict species such as the beaked hazelnut are found on this site. The south-facing slopes of this canyon also contain the Colorado wildrye/wax currant plant community, which is endemic to the northern Front Range of Colorado. The uplands are predominately ponderosa pine and Douglas-fir.

West Creek Proposed RNA

This 3,753-acre area is located on the Estes-Poudre Ranger District within the Comanche Peak Wilderness. This area adjoins the West Creek Research Natural Area in Rocky Mountain National Park. These two areas would enhance each other's values and would provide an opportunity for interagency cooperation in management, research, data-gathering, and monitoring. The area is primarily Douglas-fir, ponderosa pine and lodgepole pine forest, with a particularly large occurrence of the Douglas-fir/waxflower plant community.

North St. Vrain Proposed RNA

This 4,793-acre area is located on the Boulder Ranger District and includes approximately six miles of North St. Vrain Creek, one of the major streams that have cut deep canyons as they flow east out of the Front Range. In addition to the diverse and high quality examples of riparian vegetation, the area also contains the largest known expanses of the endemic shrubland plant community, antelope bitterbrush/mountain muhly, and stands of old-growth ponderosa pine. The north-facing slopes of the canyon are Douglas-fir forest and the south-facing slopes and uplands are mostly a mixture of shrublands, grasslands, and open ponderosa pine stands. The area also offers protection to populations of Aletes humilis, a rare plant species that is on the regional USDA Forest Service Sensitive Species list.

PAWNEE NATIONAL GRASSLAND

Indian Caves Proposed RNA

This 532-acre area is located in the northeast portion of the Pawnee National Grasslands near the Logan County line. The northern part of this area is a relatively flat upland

dominated by blue grama-buffalograss prairie containing many small depressions in which spike-rush grows. Small amounts of needle-and-thread - blue grama prairie and little bluestem-sideoats grama prairie are also found on the site. The uplands fall away to the south in a band of cliffs and steep slopes that are dominated by shrublands that include chokecherry and skunkbush.

Little Owl Creek Proposed RNA

This 1,108-acre area is located in the western portion of the Pawnee National Grasslands about six miles northeast of the town of Nunn. The area includes good examples of short-grass prairie on soils derived from the Laramie Formation. Most of the short-grass prairie is the blue grama-buffalo grass type, with smaller areas of plant communities containing varying mixtures of sideoats grama, needle-and-thread, fourwing saltbush, sand dropseed, and yucca. The area also contains riparian and lowland plant communities along intermittent streams and nearby perennial ponds, including inland saltgrass-alkali sacaton-western wheatgrass and alkali sacaton-blue grama. The area provides habitat for two USDA Forest Service Sensitive Species, the ferruginous hawk and the Iowa darter.

Keota Proposed RNA

This 827-acre area is located in the central portion of the Pawnee National Grasslands about three miles southeast of the town of Keota. The area includes good examples of short-grass prairie on soils derived from the White River Formation, with a good representation of fourwing saltbush shrublands as well as the more common blue grama-buffalo grass prairie. The area provides small rock outcrops that provide habitat for a diversity of wildlife. This proposed RNA also has known occurrences of three USDA Forest Service Sensitive Species, the ferruginous hawk, swift fox, and mountain plover.

Daves Draw

Located in the north central portion of the Pawnee National Grasslands west of Pawnee Buttes, this 263-acre area has been fenced as a natural area since 1968. The area contains a woody draw with an excellent representation of limber pine woodland and riparian shrub plant communities. These are relatively unique habitats on the western Great Plains. In addition there are good examples of mid-grass prairie.

ROUTT NATIONAL FOREST

Silver Creek Proposed RNA

The 12,250-acre Silver Creek proposed RNA is located on the Yampa Ranger District on the west flank of the Gore Range west of the Continental Divide. The area is entirely within the Sarvis Creek Wilderness and includes all of the upper Silver Creek watershed, with elevations ranging from 8,960 to 10,680 feet. Most of the area is representative of mid-elevation xeric subalpine coniferous forest dominated by lodgepole pine that has remained undisturbed by logging. Some of the lodgepole pine stands contain many individual trees that are larger and older than those found in most lodgepole pine forests. Most of the lodgepole pine forest has an understory of small spruce and fir, indicating a very slow succession to spruce-fir forest. Smaller areas of old Engelmann spruce-subalpine fir forest occur in moist and sheltered sites that have escaped recent fires. Small areas of aspen occur on rock falls and scree slopes. The area also provides good representation for some types of sedge fens and willow dominated wetlands, as well as the riparian communities of Silver Creek. The area is also notable because of the relatively gentle mountain topography that has not been influenced by Pleistocene glaciation. Access to the area is limited to foot or horse travel because of the existing wilderness designation. The recreational trail along Silver Creek receives a moderate amount of use, primarily by anglers and hunters. The Silver Dome, located in the northeast section of this area, receives light use as a recreational climbing area. The area is part of the Service Creek C&H grazing allotment, which has not been grazed since 1963.

Mad Creek Proposed RNA

This 19,440-acre area on the Hahns Peak Ranger District is partially contained within the Mount Zirkel Wilderness. This ecologically diverse area extends from montane forests to alpine tundra with elevations from 7,400 to 11,924 feet and includes the entire watershed of the South Fork of Mad Creek. The Continental Divide forms the eastern boundary of the area. In contrast to the Silver Creek area, most of the Mad Creek area has been extensively sculpted by the forces of glaciation. Large subalpine grasslands, dominated by tufted hairgrass, form a broad transition between the small area of alpine tundra above and the more extensive subalpine forests below. Small but important areas of old-growth Engelmann spruce-subalpine fir forest have been found to harbor relatively rare plant species, such as the northern wake-robin. At their highest elevations, spruce-fir forests often form ecologically interesting areas of ribbon forest. At lower elevations there are extensive stands of aspen and some shrublands on south-facing slopes. The Mad Creek area has several lakes, three of which contain the Colorado River cutthroat trout, a USDA Forest Service Sensitive species. The area also has high quality riparian plant communities. A major wilderness trail occurs along the eastern boundary and

provides access primarily to several of the mountain lakes near the northern end of the area. Luna Lake is the most used of these lakes. There are no other Forest Service system trails in the area. A few social trails occur both in the wilderness and in the southern part of area near the Forest boundary. The area is part of a vacant grazing allotment.

Williams Fork Proposed RNA

Located on the Middle Park Ranger District west of the Continental Divide, this 20,875-acre area is typical of much of the very high alpine landscape that occurs along the Front Range. Containing a number of peaks over 13,000 feet, this area includes the complete upper watersheds of the South Fork and Middle Fork of the Williams Fork. A number of well-developed glacial cirques occupy the upper ends of these creeks. Elevations range from 9,200 to 13,500 feet. This area contains a great diversity of alpine ecosystem types occurring over a very wide range of elevations, slopes, and aspects. The Williams Fork proposed RNA also contains extensive areas of subalpine forest, wetlands, and riparian ecosystems, including a large area of old-growth Engelmann spruce-subalpine fir forest. The Colorado cutthroat trout, a USDA Forest Service Sensitive species, is found here. The Forest Service trail that runs up the South Fork of the Williams Fork and then down Bobtail Creek receives a moderate amount of recreational use. The area has been closed to motorized use. The area is part of a vacant grazing allotment.

Arapaho Ridge Proposed RNA

This 13,835-acre area on the Middle Park Ranger District is found east of the Continental Divide in the Rabbit Ears Range, an east-west oriented series of mountains and ridges separating North and Middle Parks. In contrast to the other proposed RNAs on the Routt National Forest, which occur mostly on granitic and metamorphic rock types, this area occurs on Tertiary volcanic rocks, which in general produce finer, less acidic, soils. Elevations range from 9,000 to 11,819 feet. The Arapaho Ridge area contains a diverse mix of alpine tundra, subalpine grasslands, and Engelmann spruce-subalpine fir, lodgepole pine and aspen forests. Wetlands and riparian ecosystems occur along the several creeks which flow from the high mountains. Some of the ecological values of this area, which are common to most of the other proposed RNAs, include the complete watersheds of several streams and a great diversity of ecosystem types, forest successional stages, elevations, slopes, and aspects. This area represents the landscape over a great range of natural variation. The Arapaho Ridge proposed RNA currently receives a moderate amount of recreational use along a Forest Service trail that goes up the Middle Fork of Arapaho Creek over Arapaho Ridge and descends to a trailhead on the east side. This trail is currently open to motorized use and receives very light use by motorcycles. The Forest Service is proposing to close this trail to motorized used because of its unsuitability for motorized recreation and in order to protect the fragile

subalpine and alpine environment of Arapaho Ridge. This trail proposal is made irrespective of the proposal to designate the area as an RNA. The area is part of a vacant grazing allotment. (The Routt National Forest has decided to substitute the Never Summer proposed RNA for the Arapaho Ridge proposed RNA.)

Kettle Lakes Proposed RNA

Occurring east of the Continental Divide on the east side of the Park Range, this 6,512-acre area is on the North Park Ranger District. The western two thirds of the area occurs within the Mount Zirkel Wilderness. Elevations range from 8,600 to 10,600 feet. This area contains over a hundred small kettle lakes and extensive wetlands surrounding and adjacent to these lakes. The lakes were produced by glacial scouring and melting iceblocks during the Pleistocene and most of them have no inlet or outlet. This is one of largest and densest concentrations of glacially derived lakes in Colorado. The wetlands include sedge dominated fens, willow carrs, and floating mats of vegetation. Most of the surrounding forest is lodgepole pine. The extensive wetlands of Kettle Lakes provide habitat for known populations of USDA Forest Service Sensitive species, including the roundleaf sundew, wood frog, northern leopard frog, and boreal western toad. There are no Forest Service trails and negligible recreational use of this area. The area is part of an active grazing allotment, which is currently being grazed. However, the portion of the allotment within the proposed RNA is not very suitable for grazing and only rarely used by cattle.

RIO GRANDE NATIONAL FOREST

Deadman Creek Proposed RNA

This 4,779-acre area is located on the Saguache Ranger District on the western side of the Sangre de Cristo Mountains and is entirely within the Sangre de Cristo Wilderness. The area contains the complete watershed of Deadman Creek from approximately 9,200 to 13,600 feet. Because most of the middle and upper parts of this watershed are covered with aspen, this RNA provides good representation for aspen forests over a wide range of elevations, slopes, and aspects. Some of this aspen forest is seral to Engelmann spruce and subalpine fir, and at lower elevations, to Douglas-fir forests; and some of the aspen is probably climax aspen forest. The area also provides good representation for many of the alpine ecosystem types within the Sangre de Cristo Mountains and for riparian vegetation types along the stream bottom. Significant areas of mountain mahogany shrubland, oatgrass meadows, and wetland vegetation also occur within the area. This remote area does not have a maintained Forest Service trail and receives little recreational use.

Finger Mesa Proposed RNA

This 3,406-acre area occurs on the Creede Ranger District in the eastern San Juan Mountains. Finger Mesa is an isolated erosional remnant of a Tertiary volcanic plateau. As a self-contained landscape unit, it provides a complete mountain summit and surrounding slopes ranging in elevation from 11,200 to 12,300 feet. The area is distinguished by an extensive alpine area composed of a mosaic of kobresia turf, boulder fields, and areas of low alpine willows. Near treeline tufted hairgrass meadows occur near significant areas of sedge dominated wetlands. The subalpine Engelmann spruce/subalpine fir forests contain some aspen at lower elevations and are interspersed with Thurber fescue and oatgrass meadows. There are no Forest Service trails in this area, which receives little recreational use.

Hot Creek Proposed RNA

This 1,773-acre area is located on the Conejos Ranger District on the western margin of the San Luis Valley in the San Juan Mountains and ranges in elevation from 8,600 to 9,400 feet. The area is significant because it contains rare exemplary occurrences of ponderosa pine forests with a grass understory of Arizona fescue and mountain muhly. These plant communities are common at low to middle elevations on the Rio Grande National Forest but over most of the Forest they have been affected by livestock grazing, logging, or developed recreation. The small but vertical walled canyons of Hot Creek and Piedrosa Creek have made this trailless area fairly inaccessible and allowed it to remain in natural condition.

Little Squaw Creek Proposed RNA

Containing the complete watershed of Little Squaw Creek, this 20,201-acre area occurs within an unglaciated remnant of a Tertiary volcanic plateau in the eastern San Juan Mountains. Located on the Creede Ranger District entirely within the Weminuche Wilderness, it extends in elevation from 9,200 feet near the Rio Grande River to 13,014 feet at the summit of Chief Mountain. The complete watershed, large land area, and diverse ecological conditions are important features of this proposed RNA. In addition, the area is significant for its high elevation rolling plateau that contains Thurber fescue and tufted hairgrass grasslands, extensive wetlands, willow stands, and alpine tundra. Subalpine spruce-fir forests mixed with some aspen stands occur at lower elevations. Little Squaw Creek is the only major creek in this part of the San Juan Mountains that does not have a Forest Service trail along it. The meadows and riparian vegetation of this creek are an especially significant feature of this area. Two Forest Service trails provide access and receive recreational use.

Mill Creek Proposed RNA

This 2,554-acre area rises from the broad alluvial fan on the western slope of the Sangre de Cristo Mountains and is partially contained within the Sangre de Cristo Wilderness. Located on the Saguache Ranger District, it extends in elevation from 7,960 to 12,878 feet at the summit of Gibson Peak. The extensive and high quality pinyon/juniper woodlands on the relatively gentle slopes of alluvial fans and steeper bedrock extending up to about 9,000 feet are the principal feature of this area. In addition, mixed conifer and subalpine forest extend up to treeline on Gibson Peak. Subalpine grasslands blend into higher elevation alpine vegetation above treeline. Some riparian vegetation occurs along Mill Creek. There are no trails within the area, but some hiking access is provided to lower elevations by the remnants of an old mining road. This area receives negligible recreational use.

North Zapata Proposed RNA

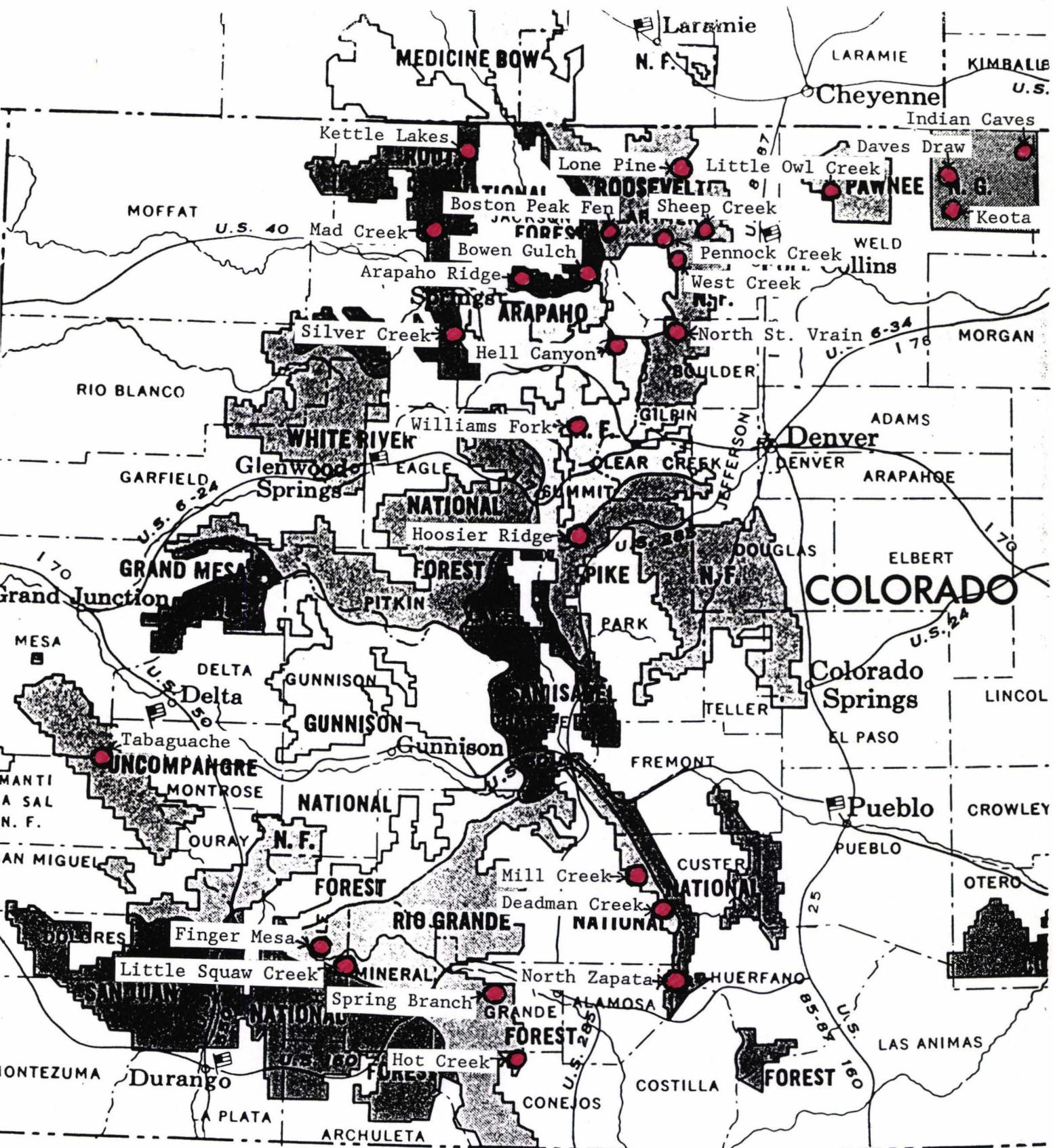
Located on the Conejos Ranger District, this 6,114-acre area is part of the steep western slope of the Sangre de Cristo Mountains and is entirely within the Sangre de Cristo Wilderness. The area consists of a series of steep ridges separated by deep, narrow canyons containing the drainages of North and South Arrastre Creeks, North Zapata Creek, and Tellurium Gulch. Vegetation extends from pinyon/juniper woodlands beginning at approximately 8,600 feet to alpine tundra at 12,300 feet. The area is notable for its high elevation limber pine stands mixed with bristlecone pine and an understory dominated by Thurber fescue. North-facing slopes support mixed montane forest, and above 11,000 feet, subalpine coniferous forest. South-facing slopes support open shrubland and woodland plant communities. Aspen stands, subalpine grasslands, and riparian forests also occur within the area. A Forest Service trail provides access to the southern boundary of the area.

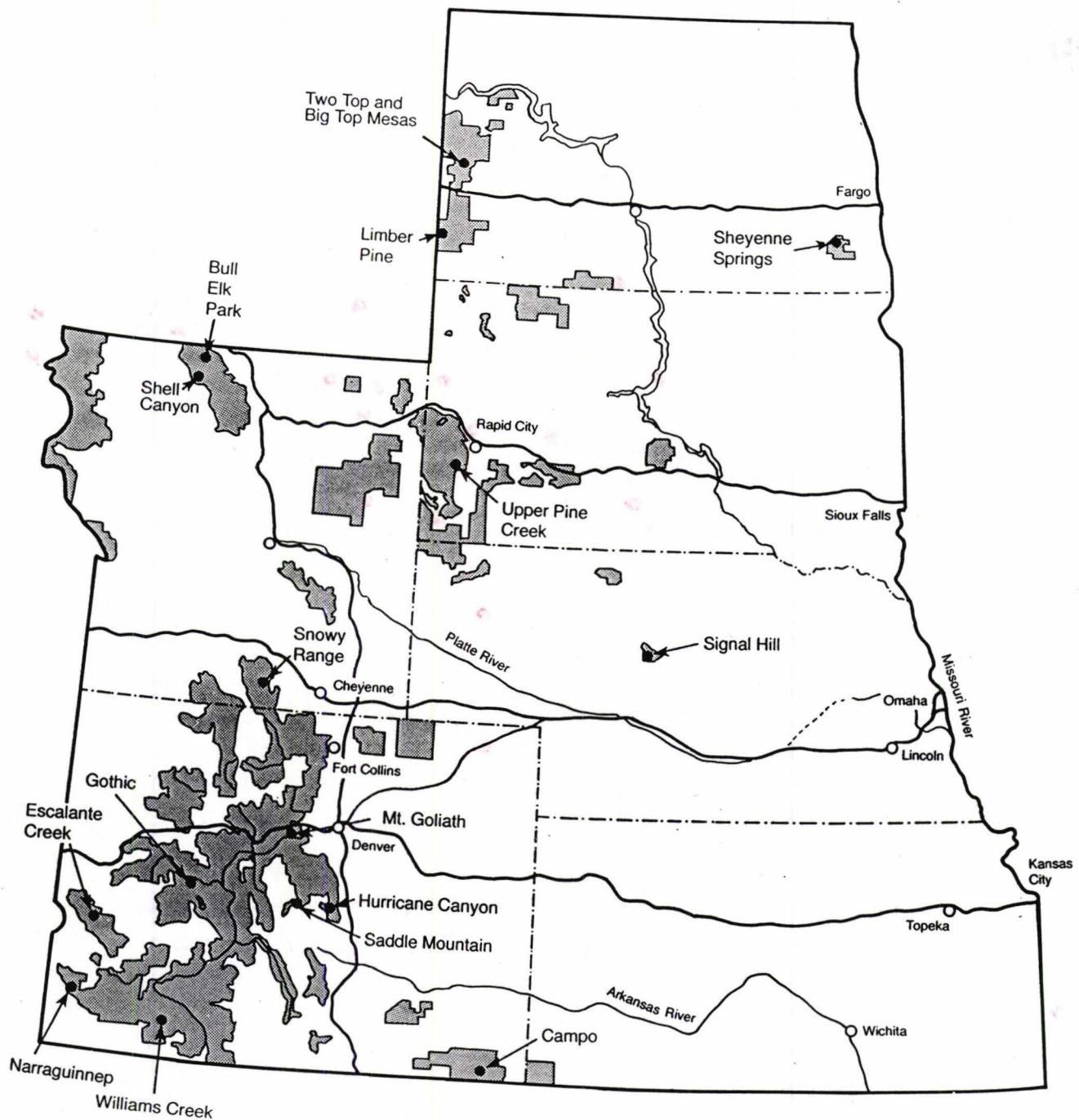
Spring Branch Proposed RNA

Located in the eastern foothills of the San Juan Mountains, this 4,052 acre area occurs on the Del Norte Ranger District and ranges in elevation from 8,200 to 10,200 feet. Most of this proposed RNA is a rolling topography covered by a mosaic of different grassland types and pinyon/juniper woodland. At higher elevations on the slopes of Horseshoe Mountain, montane forest is primarily Douglas fir mixed with limber pine and small areas of aspen. Pinyon/juniper woodland is the dominant woody vegetation type in the area. The grasslands are similar to those of the short-grass prairie further east and occur in a complex mosaic of types that include the following species: blue grama, western wheatgrass, Arizona fescue, muhly, Indian ricegrass, needlegrass, junegrass and others. Small areas of shrubland, that include mountain mahogany, snowberry, and currant, occur on ridges and ridge slopes among the pinyon-juniper woodland. This area

is prime winter range for deer and elk and receives most human usage during the hunting season. Forest Development Road 327 (Cedar Springs road), which is not included within the RNA boundaries, divides the area into two parts and provides access into its center.

FIGURE 1. PROPOSED RESEARCH NATURAL AREAS ON THE
RIO GRANDE, ROUTT, AND ARAPAHO AND ROOSEVELT NATIONAL FORESTS
AND PAWNEE NATIONAL GRASSLAND
(including Hoosier Ridge and Tabaguache proposed RNAs)

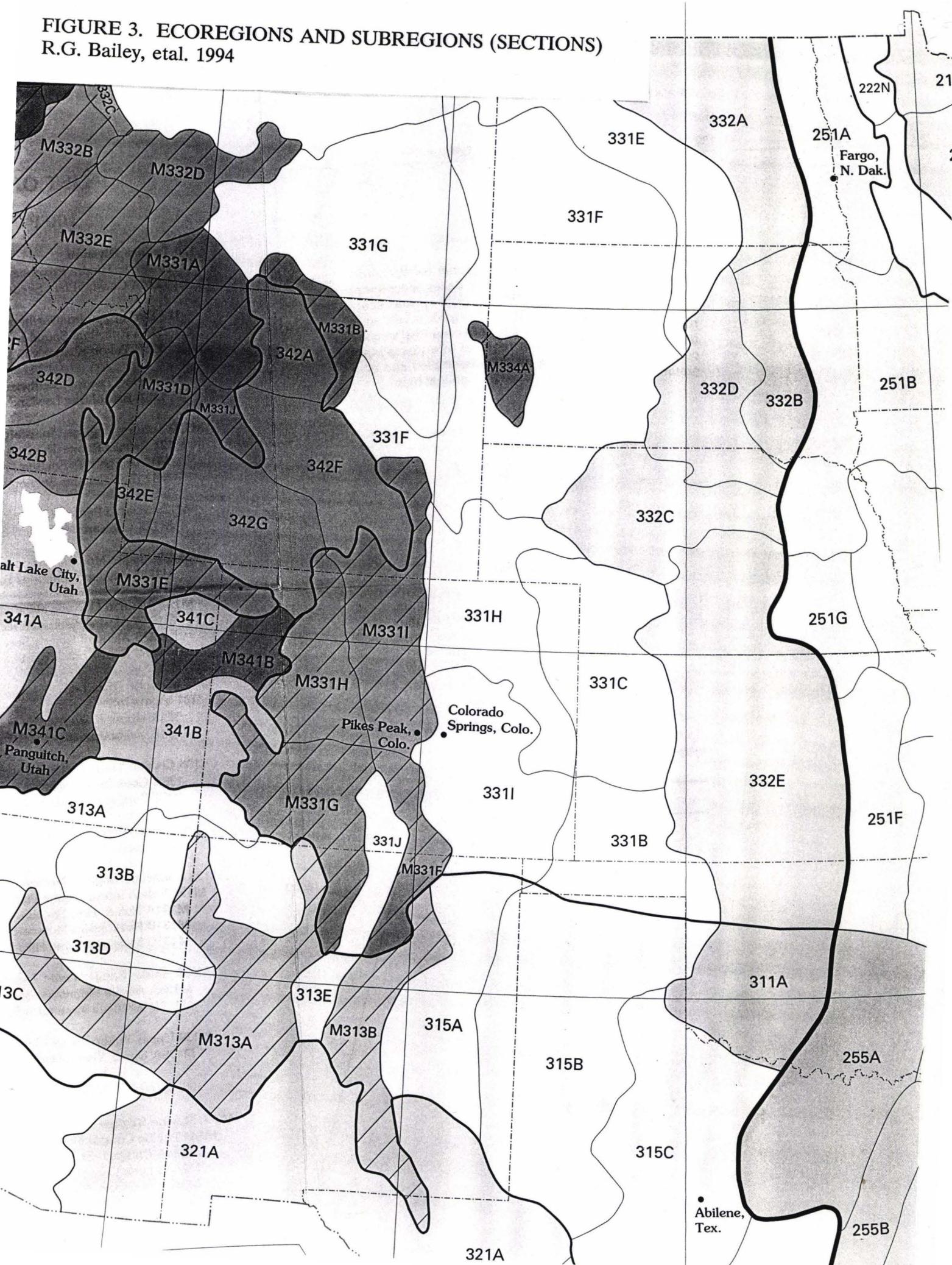




Location of RNAs in Colorado, Wyoming, Nebraska, North Dakota, and South Dakota.
Shaded areas are public lands administered by USDA Forest Service.

FIGURE 2. ESTABLISHED RESEARCH NATURAL AREAS IN THE ROCKY MOUNTAIN REGION AND NORTH DAKOTA

FIGURE 3. ECOREGIONS AND SUBREGIONS (SECTIONS)
R.G. Bailey, et al. 1994



REPRESENTATION ANALYSIS FOR RESEARCH NATURAL AREAS

ROCKY MOUNTAIN REGION USDA FOREST SERVICE

The Rocky Mountain Region of the USDA Forest Service includes approximately 22 million acres of National Forests and National Grasslands in Colorado, Kansas, Nebraska, South Dakota, and part of Wyoming. The ecological variability found in the Rocky Mountain Region is poorly represented in the 13 currently established RNAs. In order to provide for a more representative and useful RNA system, National Forests and National Grasslands in the Region are undertaking RNA analysis and proposing new RNAs during the revision of their Land and Resource Management Plans. Three National Forests (Arapaho and Roosevelt, Rio Grande, and Routt) will propose new RNAs for establishment in their Forest Plan Revisions. This report details the ecological variability that is represented in these proposed RNAs.

Ecosystem Types

Plant communities have been adopted by the RNA programs for most of the Regions of the Forest Service as units for defining ecosystem types and for identifying and targeting ecological variability. Vegetation is often reflective of other aspects of ecological variability, including climate, geology, landform, and soils. In the Rocky Mountain Region the publication "Plant Associations of Region Two," Edition 4, June 1987, by Barry Johnston has been adopted as the most complete source currently available for describing these plant communities. A matrix of Plant Series and over 450 Plant Associations and community types for all the National Forests and National Grasslands in the Region was compiled in the draft "Research Natural Area Guide for the Rocky Mountain Region," October 1993. Ecosystem types in the Rocky Mountain Region are being identified primarily by Plant Series and Plant Associations. Plant Series correspond closely with SAF Forest Cover Types and Kuchler Types that have been traditionally used to assess representation in the RNA system. Plant Associations have been adopted for the vegetation component for lower levels of the National Hierarchy.

Ecoregions

In order to capture broad geographical and climatological differences, targeting of ecosystem types for the RNA system is being done on an ecoregion basis. This approach has been adopted in many other Forest Service Regions. The United States has been divided into a hierarchical set of ecologically based subdivisions in the map by Bailey, R.G. et al. 1994. "Ecoregions and Subregions of the United States." From larger land area to smaller, these nested subdivisions are Domain, Division, Province, and Section.

The Section level has been chosen for RNA targeting. Sections are relatively large areas of land. For instance, all the National Forests in Colorado, northern New Mexico, and southern Wyoming are contained within four Sections.

It is desirable to have each of the ecosystem types found on National Forest System land in a given Section represented in at least one RNA. In addition, a certain amount of redundancy is necessary to prevent complete loss from unforeseeable catastrophic events and to increase representation and biodiversity protection. As Subsection maps are developed for the Rocky Mountain Region, they will become useful in assessing ecosystem representation in the RNA system. Because of the often significant ecological differences between mountain ranges (particularly in climate, landforms and geology), good ecosystem representation can often be aided by distributing RNAs among mountain ranges and other regionally significant physiographic subdivisions.

Representation

In evaluating the representation of ecosystem types by the RNA system, it is desirable to ask how well existing and proposed RNAs represent the range of natural variability found within each ecosystem type. The montane forests represented by the ponderosa pine/Arizona fescue ecosystem type, for instance, occur over a broad range of environmental variables, including: elevation, slope, aspect, climatic regime, landform, soil, geology, and successional stage. If the RNA system included most of the full range of these environmental gradients for all ecosystem types, it would probably be very representative of the ecosystem types managed by the Forest Service. This approach to RNA representation was investigated in recent research on bristlecone pine ecosystems. However, the capacity for this level of analysis is currently quite limited because of lack of information. Full implementation of this approach will probably require the completion of the Forest Service Integrated Resource Inventory.

Larger RNAs that include complete watersheds will represent a greater range of ecological variability. Larger RNAs are also more capable of maintaining viable populations of a greater diversity of plant and animal species and of maintaining ecological integrity in the face of outside influences. Large natural areas are particularly important for ecosystem types that have active disturbance processes such as fire and that therefore often occur in the landscape as a mosaic of successional stages. Many RNAs established in the past are currently recognized as too small to fully accomplish their purposes of representation, biodiversity protection, and maintaining ecological processes.

The three National Forests that will be proposing new RNAs in the near future in Forest Plan Revision DEISs (Arapaho and Roosevelt, Rio Grande, and Routt) are found in four Sections. These National Forests and the RNAs that will be proposed in their Forest Plan revision Draft EISs are listed by Section below. Established RNAs are also

listed and delineated by *. The representation of ecosystem types (Series and Plant Associations) within these four Sections by the RNA system is found in the attached tables. This representation is discussed in general terms below.

Southern Parks and Rocky Mountain Ranges Section, M331F

Rio Grande National Forest
Mill Creek
Deadman Creek
North Zapata

The three RNAs proposed within this Section occur on the west slope of the Sangre de Cristo Mountains. RNA analysis has not yet occurred on the San Isabel National Forest which comprises over 75 percent of the Forest Service acreage in this Section. However, the three proposed RNAs adequately represent much of the ecological diversity found on the west slope of the Sangre de Cristos. Pinyon-juniper, aspen, spruce-fir, limber pine, riparian, wetland, subalpine grassland, and alpine ecosystem types are represented across a wide range of environmental variables within these three proposed RNAs.

South-Central Highlands Section, M331G

Rio Grande National Forest
Finger Mesa
Little Squaw Creek
Spring Branch
Hot Creek
San Juan National Forest
Narraguinnep *
Williams Creek *
Grand Mesa, Uncompahgre and Gunnison National Forests
Escalante Creek *

The San Juan National Forest and portions of the Gunnison and Uncompahgre National Forests comprise approximately two-thirds of this Section. These Forests have not yet completed RNA analysis. The four RNAs proposed on the Rio Grande National Forest represent much of the ecological diversity found within the San Juan Mountains east of the Continental Divide. Spring Branch includes lower elevation grasslands and pinyon-juniper woodlands, and Hot Creek includes a good representation of ponderosa pine forests. The spruce-fir and alpine high country, as well as successional aspen forests, are provided good representation by Finger Mesa and Little Squaw Creek proposed RNAs. Most of the eastern San Juan Mountains are composed of rocks of volcanic origin.

These proposed RNAs give a good representation of the diversity of vegetation found on this volcanic substrate. The more xeric examples of ecosystem types found in the northeastern San Juans in the Saguache District, as well as examples of ecosystem types in the southeastern San Juans in the Conejos District, are not represented in proposed RNAs because areas could not be found that didn't conflict with existing land use.

North-Central Highlands and Rocky Mountain Section, M331H

Routt National Forest
Silver Creek
Mad Creek
Grand Mesa, Uncompahgre and Gunnison National Forests
Gothic *

Because the western part of the Routt National Forest comprises less than 25 percent of this Section, these two proposed RNAs only make a small beginning toward representing the ecological diversity of this Section. However, for the west slope of the Park and northern Gore Ranges, the proposed RNAs provide good representation. A good selection of alpine, spruce-fir, lodgepole pine, aspen, subalpine grassland, riparian, and wetland ecosystems occur over a wide range of environmental variables in these proposed RNAs.

Northern Parks and Ranges Section, M331I

Arapaho and Roosevelt National Forests
Boston Peak Fen
Lone Pine Creek
Pennock Creek
West Creek
Sheep Creek
North St. Vrain
Hell Canyon
Bowen Gulch
Mt. Goliath *
Routt National Forest
Arapaho Ridge
Williams Fork
Pike and San Isabel National Forests
Saddle Mountain *
Hurricane Ridge *
Hoosier Ridge (proposed for establishment via Environmental Assessment
- part of the area occurs on the White River National Forest)

Medicine Bow National Forest
Snowy Range *

The ecosystem types of the northern part of the Front Range are well represented by the proposed RNAs on the Arapaho and Roosevelt National Forests. Much of the diversity found in the extensive ponderosa pine and Douglas-fir forests of the Front Range is represented within Lone Pine Creek, West Creek, and North St. Vrain proposed RNAs. Montane grasslands and riparian ecosystems are also represented by these areas. If the Ashenfelder Basin proposed RNA on the Medicine Bow National Forest and additional areas to the south on the Pike National Forest were included, montane forests in this Section would have excellent RNA representation. Higher elevation spruce-fir and lodgepole pine forests and alpine ecosystems receive good representation in the Pennock Creek, Hell Canyon, Bowen Gulch, Williams Fork, and Arapaho Ridge proposed RNAs. The lodgepole pine and alpine ecosystem types east of the Continental Divide are not represented in proposed or established RNAs at present; however, west of the Continental Divide these ecosystem types are well represented. The diversity of aspen and shrubland Plant Associations is also not well represented in these proposed RNAs. Wetland and riparian ecosystem types in this Section are well represented by the proposed RNAs.

In general, aspen stands and lower elevation ecosystem types have proven more difficult to represent in the RNA system because these areas are often being actively grazed by domestic livestock. It has been regional practice to select most potential RNA sites from National Forest System lands that are in vacant or closed grazing allotments or portions of active allotments not used by livestock.

Pawnee National Grassland

In addition to the proposed RNAs on the National Forests, three RNAs will be proposed for establishment on the Pawnee National Grassland in the draft EIS for the Arapaho and Roosevelt National Forests and Pawnee National Grassland Plan Revision: Keota, Indian Caves, and Little Owl Creek. A fourth RNA on the Pawnee National Grassland, Daves Draw, is proposed for establishment and an Environmental Assessment for this RNA is almost complete. These proposed RNAs occur in the Central High Plains Section, 331H. A representation analysis for this Section will be completed following the acquisition of additional plant community data during the summer of 1995. Because of the ubiquity of livestock grazing on National Grasslands, it is usually necessary to select potential RNAs from active allotments.

Other National Forests

The Medicine Bow National Forest has also completed the initial stages of RNA analysis and has had ecological evaluations completed on thirteen potential RNA sites. These sites will be included in regional RNA analysis in the future as the Medicine Bow progresses in its Plan Revision process.

The five other established RNAs in the Rocky Mountain Region are described fully in "Research Natural Areas", General Technical Report RM-251, Rocky Mountain Forest and Range Experiment Station, September 1994, and are shown on the attached map. This report will be updated as additional information from RNA analyses on other National Forests and National Grasslands becomes available.

PLANT ASSOCIATIONS AND COMMUNITY TYPES IN NATIONAL FORESTS AND ESTABLISHED AND PROPOSED RESEARCH NATURAL AREAS

O – indicates the known occurrence of a plant association or community type on a National Forest.

* National Forests in Section M331L: MD = Medicine Bow – eastern part, RT = Routt – eastern part, AR = Arapaho and Roosevelt – all, WR = White River – small eastern part, PS = Pike and San Isabel – northern part.

** The name of the Research Natural Area is followed by the abbreviation for its National Forest; its status: pr = proposed in Plan Revision DEIS, es = established; the degree of representation of the Plant Association in the RNA: M = major, m = minor.

*** Shading indicates the known occurrence of a Series on a National Forest.

**** RNAs are listed under Series they contain when plant association data is not available.

XX Series which probably occur on National Forests but are not substantiated by plant association data.

SERIES	PLANT ASSOCIATIONS AND COMMUNITY TYPES	NATIONAL FOREST *				RESEARCH NATURAL AREA **
		MB	RT	AR	WRPS	
UPLAND SERIES						
PONDEROSA PINE SERIES						Hurricane Canyon – PS – es – m ?
Ponderosa Pine	Pipo/Cahe1 (<i>Pinus ponderosa/Carex heliophila</i>)		O		O	
	Pipo/Arad (<i>Arctostaphylos adenotricha</i>)	O			O	Lone Pine – AR – pr – M
	Pipo/Cage1 (<i>Carex geyeri</i>)	O	O	O	O	
	Pipo/Caro3 (<i>Carex rossii</i>)	O		O		North St. Vrain – AR – pr – M
	Pipo/Cemo (<i>Cercocarpus montanus</i>)		O		O	
	Pipo/Fear1 (<i>Festuca arizonica</i>)				O?	
	Pipo/Leki (<i>Leucopoa kingii</i>)		O			Lone Pine – AR – pr – m North St. Vrain – AR – pr – m
	Pipo/Putr (<i>Purshia tridentata</i>)		O			West Creek – AR – pr – M North St. Vrain – AR – pr – M
	Pipo–Psme/Mumo1 (<i>Pseudotsuga menziesii/Muhlenbergia montana</i>)		O	O		
DOUGLAS-FIR SERIES						Saddle Mountain – PS – es – M? **** Hurricane Canyon – PS – es – M
Douglas-fir	Psme/Caro3 (<i>Pseudotsuga menziesii/Carex rossii</i>)		O			
	Psme/Arad–Juco (<i>Arctostaphylos adenotricha–Juniperus communis</i>)		O		O	
	Psme/Pamy (<i>Paxistima myrsinoides</i>)	O		O		
	Psme/Jaam (<i>Jamesia americana</i>)		O		O	West Creek – AR – pr – M North St. Vrain – AR – pr – M
	Psme/Phmo (<i>Physocarpus monogynus</i>)	O	O	O	O	Lone Pine – AR – pr – M North St. Vrain – AR – pr – M

SERIES	PLANT ASSOCIATIONS AND COMMUNITY TYPES	MB	RT	AR	WRPS	RESEARCH NATURAL AREA **
Douglas-fir	Psme/Cage1 (<i>Carex geyeri</i>)		O			
	Psme/Syor1 (<i>Symphoricarpos oreophilus</i>)		O	O	O	
LODGEPOLE PINE SERIES						Snowy Range – MB – es – M/m ?
Lodgepole Pine	Pico/Arad (<i>Pinus contorta/Arctostaphylos adenotricha</i>)	O	O	O		
	Pico/Cage1 (<i>Carex geyeri</i>)	O	O	O		
	Pico/Caro3 (<i>Carex rossii</i>)	O				Hell Canyon – AR – pr – M
	Pico/Juco (<i>Juniperus communis</i>)	O	O			Pennock Creek – AR – pr – m
	Pico/Shca (<i>Shepherdia canadensis</i>)	O	O	O		Hell Canyon – AR – pr – M
	Pico/Vamy (<i>Vaccinium myrtillus</i>)		O?			
	Pico/Vasc (<i>Vaccinium scoparium</i>)	O	O	O		Hell Canyon – AR – pr – M Bowen Gulch – AR – pr – M
LIMBER PINE SERIES			XX	XX		
Limber Pine	Pifl/Capu1 (<i>Pinus flexilis/Calamagrostis purpurascens</i>)		O			
	Pifl/Juco (<i>Juniperus communis</i>)	O	O	O		Boston Peak Fen – AR – pr – m
	Pifl/Leki (<i>Leucopoa kingii</i>)	O				
	Pifl/Trda (<i>Trifolium dasypodium</i>)		O			Pennock Creek – AR – pr – M
BRISTLECONE PINE SERIES						
Bristlecone Pine	Piar/Fear1 (<i>Pinus aristata/Festuca arizonica</i>)			O		
	Piar/Feth (<i>Festuca thurberi</i>)		O	O		
	Piar/Juco (<i>Juniperus communis</i>)		O			Mt. Goliath – AR – es – m
	Piar/Trda (<i>Trifolium dasypodium</i>)			O		Mt. Goliath – AR – es – M
ENGELMANN SPRUCE SERIES		XX				
Engelmann Spruce	Pien1/moss (<i>Picea engelmannii/moss understory</i>)			O		
	Pien1/Trda (<i>Trifolium dasypodium</i>)		O			
	Pien1/Trpa (<i>Trifolium parryi</i>) [possible PA – previously undescribed]	O				Arapaho Ridge – RT – pr – m
	Pien1/Vasc (<i>Vaccinium scoparium</i>)	O	O	O		
	Pien1/Vamy (<i>Vaccinium myrtillus</i>)			O		
SUBALPINE FIR SERIES						Snowy Range – MB – es – M ? Saddle Mountain – PS – es – m
Subalpine Fir	Abla/Cage1 (<i>Abies lasiocarpa/Carex geyeri</i>)		O			
	Abla-Pien1Caru1 (<i>Calamagrostis rubescens</i>)	O				
	Abla-Pien1/Cage1 (<i>Calamagrostis geyeri</i>)	O	O	O	O?	
	Abla-Pien1/Libo (<i>Linnaea borealis</i>)		O	O?	O	Bowen Gulch – AR – pr – M
	Abla-Pien1/moss (moss understory)	O	O			
	Abla-Pien1/RIBE (<i>Ribes spp.</i>)			O?	O	
	Abla-Pien1/Sagi1 (<i>Salix glauca</i>)		O	O	O	Hoosier Ridge – WR/PS – pr – m
	Abla-Pien1/Vace (<i>Vaccinium cespitosum</i>)	O				

SERIES	PLANT ASSOCIATIONS AND COMMUNITY TYPES	MB	RT	AR	WRPS	RESEARCH NATURAL AREA **
Subalpine fir	Abla–Pien1/Vasc (<i>Vaccinium scoparium</i>)	O	O	O	O	Hell Canyon – AR – pr – M Bowen Gulch – AR – pr – M Pennock Creek – AR – pr – M Boston Peak Fen – AR – pr – m Arapaho Ridge – RT – pr – M Williams Fork – RT – pr – M Kettle Lakes – RT – pr – M
	Abla–Pien1/Vamy (<i>Vaccinium myrtillus</i>)			O	O	Pennock Creek – AR – pr – M Boston Peak Fen – AR – pr – m Arapaho Ridge – RT – pr – M Williams Fork – RT – pr – M
	Abla–Pien1/Luar–Assp (<i>Lupinus argenteus</i> – – <i>Astragalus spatulatus</i>) [possible PA – previously undescribed]	O				Arapaho Ridge – RT – pr – m
ASPEN SERIES				XX		Saddle Mountain – PS – es – M ?
Aspen	Potr1/Amal–Pavi (<i>Amelanchier alnifolia</i> – <i>Padus virginiana</i>)	O	O	O		Hell Canyon – AR – pr – m
	Potr1/Caru1 (<i>Calamagrostis rubescens</i>)	O	O			
	Potr1/Cage1 (<i>Carex geyeri</i>)	O	O	O	O	Arapaho Ridge – RT – pr – m
	Potr1/Feth (<i>Festuca thurberi</i>)		O	O	O	
	Potr1/Hesp (<i>Heracleum sphondylium</i>)		O	O		
	Potr1/Juco (<i>Juniperus communis</i>)	O				
	Potr1/Lale (<i>Lathyrus leucanthus</i>)	O	O	O		
	Potr1/LIGU (<i>Ligusticum spp.</i>)	O	O	O	O	
	Potr1/Ptaq (<i>Pteridium aquilinum</i>)		O	O		
	Potr1/Syor1 (<i>Syphoricarpos oreophilus</i>)		O	O		
	Potr1/Thfe1 (<i>Thalictrum fendleri</i>)		O	O	O	Kettle Lakes – RT – pr – m
	Potr1/Vete (<i>Veratrum tenuipetalum</i>)	O	O			
JUNIPER AND PINYON SERIES					XX	
One-seeded Juniper	Jumo/Boci (<i>Juniperus monosperma</i> / <i>Bouteloua curtipendula</i>)				O	
	Jumo/Bogr (<i>Bouteloua gracilis</i>)				O	
Pinyon Pine	Pied/Bogr (<i>Pinus edulis</i> / <i>Bouteloua gracilis</i>)				O	
	Pied–Jumo/Cemo (<i>Juniperus monosperma</i> / <i>Cercocarpus montanus</i>)				O	
ROCKY MOUNTAIN JUNIPER SERIES						
Rocky Mountain Juniper	Jusc/Artr (<i>Juniperus scopulorum</i> / <i>Artemisia tridentata</i>)			O		
	Jusc/Cemo (<i>Cercocarpus montanus</i>)			O		
	Jusc/Putr (<i>Purshia tridentata</i>)			O		
	Jusc/Rosp (<i>Roegneria spicata</i>)	O	O	O		
MOUNTAIN MAHOGANY AND SERVICEBERRY SERIES						
Mountain Mahogany	Cemo/Elda (<i>Cercocarpus montanus</i> / <i>Elytrigia dasystachya</i>)			O		
	Cemo/Mumo1 (<i>Muhlenbergia montana</i>)				O	
	Cemo/Stco1 (<i>Stipa comata</i>)			O		

SERIES	PLANT ASSOCIATIONS AND COMMUNITY TYPES	MB	RT	AR	WRPS	RESEARCH NATURAL AREA **
Serviceberry	AMEL/Cage1 (<i>Amelanchier</i> spp./ <i>Carex geyeri</i>)	O	O	O	O	
ROCK, SCREE, AND CLIFF VEGETATION SERIES				■		
Gooseberry Currant	Rimo/Aqco (<i>Ribes montigenum</i> / <i>Aquilegia coerulea</i>)			O		
Red Raspberry	Ruid/Aqco (<i>Rubus idaeus</i> / <i>Aquilegia coerulea</i>)			O		
BIG SAGEBRUSH SERIES		■	■	■	■	
Big Sagebrush	Artr/Feid (<i>Artemisia tridentata</i> / <i>Festuca idahoensis</i>)	O	O	O	O	
	Artr/Feth (<i>Festuca thurberi</i>)		O	O	O	
	Artr/Leam (<i>Leymus ambiguus</i>)			O		
	Artr/Leci (<i>Leymus cinereus</i>)			O		
	Artr/Leki (<i>Leucopoa kingii</i>)			O		
	Artr-Putr/Elda (<i>Purshia tridentata</i> / <i>Elytrigia dasystachya</i>)	O		O		Hell Canyon – AR – pr – M
	Artr-Putr/Elsm (<i>Elytrigia smithii</i>)	O		O		
	Artr/Rosp (<i>Roegneria spicata</i>)	O	O	O		
	Artr/Stco1 (<i>Stipa comata</i>)			O		
	Artr/Stne (<i>Stipa nelsoniana</i>)			O	O	
ALKALI AND THREETIP SAGEBRUSH SERIES		■	■	■	■	
Alkali Sagebrush	Arlo3/Rosp (<i>Artemisia longiloba</i> / <i>Roegneria spicata</i>)		O?			
Threetip Sagebrush	Artr1/Feid (<i>Artemisia tripartita</i> / <i>Festuca idahoensis</i>)	O	O			
BITTERBRUSH SERIES		■	■	■	■	
Bitterbrush	Putr/Mumo1 (<i>Purshia tridentata</i> / <i>Muhlenbergia montana</i>)			O		North St. Vrain – AR – pr – M
	Putr-Artr/Feid (<i>Festuca idahoensis</i>)	O	O	O		
	Putr/Stco1 (<i>Stipa comata</i>)			O		
SILVER SAGEBRUSH SERIES		■	■	■	■	
Silver Sagebrush	Arca3/Feth (<i>Festuca thurberi</i>)		O	O		
	Arca3/Elsm (<i>Elytrigia smithii</i>)		O?			
IDaho FESCUE AND WILD RYE SERIES				■	■	
Idaho Fescue	Feid/Dece (<i>Deschampsia cespitosa</i>)			O	O	Hoosier Ridge – WR/PS – pr – m
	Leam/Rice (<i>Leymus ambiguus</i> / <i>Ribes cereum</i>)			O		Sheep Creek – AR – pr – M
THURBER FESCUE SERIES				■	■	
Thurber Fescue	Feth/Dapa1 (<i>Festuca thurberi</i> / <i>Danthonia parryi</i>)				O	
	Feth/Feid (<i>Festuca idahoensis</i>)	O	O	O		
	Feth/Viam-Lale (<i>Vicia americana</i> – <i>Lathyrus leucanthus</i>)		O	O		
PARRY OATGRASS, ARIZONA FESCUE, AND MOUNTAIN MUHLY SERIES		■	■	■	■	
Parry Oatgrass	Dapa1/Cahe1 (<i>Danthonia parryi</i> / <i>Carex heliophila</i>)			O		Lone Pine – AR – pr – M
					O	North St. Vrain – AR – pr – m
Arizona Fescue	Dapa1/Cast (<i>Carex stenophylla</i>) [not described in Johnston]				O	Saddle Mountain – PS – es – M/m ?
	Fear1/Mumo1 (<i>Festuca arizonica</i> / <i>Muhlenbergia montana</i>)				O	Saddle Mountain – PS – es – M ?
	Mumo1/Fear1 (<i>Festuca arizonica</i>)				O	

SERIES	PLANT ASSOCIATIONS AND COMMUNITY TYPES	MB	RT	AR	WFPS	RESEARCH NATURAL AREA **
BLUEBUNCH WHEATGRASS AND NEEDLE-AND-THREAD SERIES						
Bluebunch Wheatgrass Needle-and-thread	Rosp/Pose (<i>Roegneria spicata/Poa secunda</i>)	O	O	O		
	Rosp/Pofe (<i>Poa fenderiana</i>)			O		
	Stco1/Bogr (<i>Stipa comata/Bouteloua gracilis</i>)	O	O			
	Stco1/Mumo1 (<i>Muhlenbergia montana</i>)			O		West Creek - AR - pr - m
	Stco1/Caeb (<i>Carex ebenea</i>)	O				
TIMBER OATGRASS SERIES						
Timber Oatgrass	Dain/Podi (<i>Danthonia intermedia/Potentilla diversifolia</i>)		O	O		
ALPINE GRASSLAND AND RIDGE SERIES						
Water Sedge	Caaq/Pegr1 (<i>Carex aquatilis/Pedicularis groenlandica</i>)		O			Williams Fork - RT - pr - M
Capillaris Sedge	Caca3/Bivi (<i>Carex capillaris/Bistorta vivipara</i>)		O			
Elynoidea Sedge	Cael/OREO (<i>Carex elynoides/Oreoxis sp.</i>)		O			
Elynoidea Sedge	Cael/Trda (<i>Trifolium dasypodium</i>)		O			
Cloud Sedge	Caha/Poar2 (<i>Carex haydeniana/Poa arctica</i>)		O			
Microglochin Sedge	Cami3/Bivi (<i>Carex microglochin/Bistorta vivipara</i>)		O			
Black Alpine Sedge	Cani/JUNC (<i>Carex nigricans/Juncus spp.</i>)		O			
Pyrenees Sedge	Capy/Erme (<i>Carex pyrenaica/Erigeron melanocephalus</i>)		O			
Cliff Sedge	Casc2/Cale1 (<i>Carex scopulorum/Caltha leptosepala</i>)		O	O		Hell Canyon - AR - pr - m
Foenea Sedge	Cafo/Acro (<i>Carex foenea/Acomastylis rossii</i>)		O			
Fendler's Poa	Pofe-Cage (<i>Poa fendleriana-Carex geyeri</i>) [possible PA - previously undescribed]	O				Arapaho Ridge - RT - pr - M
Tufted Hairgrass	Dece/Acro (<i>Deschampsia cespitosa/Acomastylis rossii</i>)	O	O	O		Hell Canyon - AR - pr - M
Kobresia	Komy/Trda (<i>Kobresia myosuroides/Trifolium dasypodium</i>)		O	O		Hoosier Ridge - WR/PS - pr - M
	Komy/Acro-Caru (<i>Acomastylis rossii-Carex rupestris</i>)		O	O		Hell Canyon - AR - pr - M
	Komy/Trna (<i>Trifolium nanum</i>)			O		Hoosier Ridge - WR/PS - pr - M
Golden Avens	Kosi/Bivi (<i>Kobresia sibirica/Bistorta vivipara</i>)		O			
	Acro/Bibi2 (<i>Acomastylis rossii/Bistorta bistortoides</i>)		O	O	O	Williams Fork - RT - pr - M
	Acro/Caru (<i>Carex rupestris</i>)			O		
	Acro/Trda (<i>Trifolium dasypodium</i>)	O				
	Acro/TRIF-Dece (<i>Trifolium sp.-Deschampsia cespitosa</i>)	O	O			
Pussytoes	Acro-Poa spp. (community type identified in Establishment Record)					Hoosier Ridge - WR/PS - pr - m
Marsh-Marigold	Anme/Poar2 (<i>Antennaria media/Poa arctica</i>)		O			
Alpine Thistle	Cale1/Cirh (<i>Caltha leptosepala/Clementsia rhodantha</i>)		O			
Alpine Spring-Beauty	Cisc/Aqco (<i>Cirsium scopulorum/Aquilegia coerulea</i>)		O			
Sibbaldia	Clme/Sasa (<i>Claytonia megarhiza/Sagina saginoides</i>)		O			
	Clme/Siac (<i>Silene acaulis</i>)		O			
	Sipr/Capy (<i>Sibbaldia procumbens/Carex pyrenaica</i>)		O			
	Sipr/Libi-moss (<i>Lidia biflora-moss</i>)		O			Hell Canyon - AR - pr - M

SERIES	PLANT ASSOCIATIONS AND COMMUNITY TYPES	MB	RT	AR	WRPS	RESEARCH NATURAL AREA **
Sibbaldia	Sipr/Caeb (<i>Sibbaldia procumbens/Carex ebenea</i>)	O				
Sky Pilot	Povi/Phse-Cisc (<i>Polemonium viscosum/Phacelia sericea-Cirsium scopulorum</i>)		O			
Arctic Willow	Saar/Acro (<i>Salix arctica/Acomastylis rossii</i>)		O	O		Williams Fork - RT - pr - M
Parry Clover	Trpa/Dece (<i>Trifolium parryi/Deschampsia cespitosa</i>)		O			
Valerian	Trpa/Raad (<i>Ranunculus adoneus</i>)		O			
Valerian	Vaca2/Cebe2 (<i>Valeriana capitata/Cerastium beeringianum</i>)			O		
ALPINE FELLFIELD SERIES		XX				
Arapaho Sedge	Caar3/Libi (<i>Carex arapahoensis/Lidia biflora</i>)		O			
Spikenard Sedge	Cana/Beal (<i>Carex nardina/Besseyea alpina</i>)		O			
Mt. Baldy Sedge	Cape1/Siac (<i>Carex perglobosa/Silene acaulis</i>)		O			
Curly Sedge	Caru/Libi (<i>Carex rupestris/Lidia biflora</i>)		O			Pennock Creek - AR - pr - M
	Caru/Trda (<i>Trifolium dasypodium</i>)		O			
Reedgrass	Capu/Pogl (<i>Calamagrostis purpurascens/Poa glauca</i>)		O			Arapaho Ridge - RT - pr - M
Mountain Dryad	Droc/Caru (<i>Dryas octopetala/Carex rupestris</i>)		O	O		Hoosier Ridge - WR/PS - pr - m ?
Alumroot	Hebr-Hepa2/Erpi2 (<i>Heuchera bracteata-Heuchera parvifolia/Erigeron pinnatisectus</i>)		O			
Drummond Rush	Judr/Sipr (<i>Juncus drummondii/Sibbaldia procumbens</i>)		O			
Rocky Mtn. Nailwort	Papu/Libi (<i>Paronychia pulvinata/Lidia biflora</i>)		O			
Alpine phlox	Phsi/Trda (<i>Phlox sibirica/Trifolium dasypodium</i>)			O		
Serpentifolia Saxifrage	Sase/Febr (<i>Saxifraga serpentifolia/Festuca brachyphylla</i>)		O			
Whiproot Clover	Trda/Caru (<i>Trifolium dasypodium/Carex rupestris</i>)			O		
	Trda/Epsc (<i>Elymus scribneri</i>)			O		
Dwarf Clover	Trda/Libi (<i>Lidia biflora</i>)		O			
Parry Clover	Trna/Libi (<i>Trifolium nanum/Lidia biflora</i>)		O	O		
	Trpa/Acro (<i>Trifolium parryi/Acomastylis rossii</i>)		O			

WETLAND AND RIPARIAN SERIES		MB	RT	AR	WRPS	
BLUE SPRUCE SERIES						
Blue Spruce	Pipu/Alint (<i>Picea pungens/Alnus incana spp. tenuifolia</i>)		O	O		Sheep Creek - AR - pr - ?
	Pipu/Arco2 (<i>Arnica cordifolia</i>)	O	O			North St. Vrain - AR - pr - m
ENGLEMANN SPRUCE SERIES						
Engelmann Spruce	Pien1/Alint-Caca (<i>Picea engelmannii/Alnus incana ssp. tenuifolia - Calamagrostis canadensis</i> (not in B.Johnston))		O			North St. Vrain - AR - pr - M
SUBALPINE FIR SERIES					XX	
Subalpine Fir	Abla-Pien1/Caca (<i>Abies lasiocarpa-Picea engelmannii/Calamagrostis canadensis</i>)	O	O	O		Williams Fork - RT - pr - m
	Abla-Pien1/Setr (<i>Picea engelmannii/Senecio triangularis</i>)	O	O	O		Bowen Gulch - AR - pr - M/m

SERIES	PLANT ASSOCIATIONS AND COMMUNITY TYPES	MB	RT	AR	WFPS	RESEARCH NATURAL AREA **
NARROWLEAF COTTONWOOD SERIES		XX		XX		
Narrowleaf Cottonwood	Poan3/Amal (<i>Populus angustifolia/Amelanchier alnifolia</i>) Poan3/Saex-Befo (<i>Salix exigua–Betula fontinalis</i>)	O	O			North St. Vrain – AR – pr – M
THINLEAF ALDER AND HAZELNUT SERIES						
Thinleaf Alder	Alint-Befo/SALI (<i>Alnus incana spp. tenuifolia–Betula fontinalis/</i> <i>/Salix spp.</i>)	O	O			Sheep Creek – AR – pr – ? North St. Vrain – AR – pr – M
Hazelnut	<i>Corylus cornuta/Viola canadensis</i>		O			Sheep Creek – AR – pr – M North St. Vrain – AR – pr – m
MONTANE WILLOW SERIES				XX	XX	
Geyer Willow	Sage-SALI/Caca (<i>Salix geyeriana–Salix spp./</i> <i>Calamagrostis canadensis</i>) Sage-SALI/Caut (<i>Salix spp./Carex utriculata</i>)	O	O	O		Hell Canyon – AR – pr – M Boston Peak Fen – AR – pr – m Arapaho Ridge – RT – pr – m Kettle Lakes – RT – pr – M ?
SUBALPINE WILLOW AND BIRCH SERIES						
Grayleaf Willow	Sagl1/Acqo (<i>Salix glauca/Acomastylis rossii</i>)			O		
Planeleaf Willow	Sagl1-SALI/CARE (<i>Salix spp./Carex spp.</i>) Sagl1-Sabr1/Dece (<i>Salix brachycarpa/Deschampsia cespitosa</i>) Saphp/Cale1 (<i>Salix phylicifolia spp. planifolia/Caltha leptosepala</i>) Saphp/Caaq (<i>Carex aquatilis</i>)			O	O	Hoosier Ridge – WR/PS – pr – m Hoosier Ridge – WR/PS – pr – m
Wolf Willow	Saphp/Casc2 (<i>Carex scopulorum</i>) Saphp/Dece (<i>Deschampsia cespitosa</i>) Sawo-Sapl/Caaq-Caut (<i>Salix wolfii–Salix planifolia/Carex aquatilis–</i> <i>Carex utriculata</i>) [possible PA – previously undescribed]	O		O		Bowen Gulch – AR – pr – m Arapaho Ridge – RT – pr – M Williams Fork – RT – pr – M
Bog Birch	Begl/Casc2 (<i>Betula glandulosa/Carex scopulorum</i>)	O				Hell Canyon – AR – pr – M Arapaho Ridge – RT – pr – M
TUFTED HAIRGRASS, REEDGRASS, SEDGE AND FORB SERIES					XX	
Bluejoint Reedgrass	Caca-Casc2/Meci (<i>Calamagrostis canadensis–Carex scopulorum/</i> <i>Mertensia ciliata</i>)			O		
Tufted Hairgrass	Dece/Cale1 (<i>Deschampsia cespitosa/Caltha leptosepala</i>)			O	O	Williams Fork – RT – pr – M
Mountain Bluebells	Dece/CARE (<i>Carex spp.</i>)	O				
Water Sedge	Meci/Dece (<i>Mertensia ciliata/Deschampsia cespitosa</i>)			O		
Common Spikesedge	Caaq/Caut (<i>Carex aquatilis/Carex utriculata</i>)	O	O	O	O	Bowen Gulch – AR – pr – m Boston Peak Fen – AR – pr – m Kettle Lakes – AR – pr – M ?
Baltic Rush	Elpa/CARE (<i>Eleocharis palustris/Carex spp.</i>)	O				
Bitter-Cress	Juar/CARE (<i>Juncus arcticus/Carex spp.</i>)		O	O		
Parry Primrose	Caco2/Cale1 (<i>Cardamine cordifolia/Caltha leptosepala</i>) Prpa2/Dece (<i>Primula parryi/Deschampsia cespitosa</i>)		O		O	

SERIES	PLANT ASSOCIATIONS AND COMMUNITY TYPES	MB	RT	AR	WR	PS	RESEARCH NATURAL AREA **
Brook Saxifrage	Saod/Dece (<i>Saxifraga odontoloma/Deschampsia cespitosa</i>)			O			
Golden Ragwort	Setr/Lifi (<i>Senecio triangularis/Ligusticum filicinum</i>)			O			

Plant associations and community types are taken from Johnston, B. 1987. Plant Associations of Region Two. Edition 4. Rocky Mountain Region, R2-ECOL-87-2. Some potential Plant Associations identified during ecological evaluations of potential RNAs are also listed. As this matrix indicates, our current knowledge of plant associations and community types on a number of National Forests is very incomplete.

PLANT ASSOCIATIONS AND COMMUNITY TYPES IN NATIONAL FORESTS AND ESTABLISHED AND PROPOSED RESEARCH NATURAL AREAS

Sections M331F and M331G have been combined in this matrix for display purposes and will be separated in the future as additional RNAs are proposed.

O – indicates the known occurrence of a plant association or community type on a National Forest.

* National Forests in Section M331G: GU = Gunnison–southern part and Uncompahgre—all, SJ = San Juan—all, RG = Rio Grande–western part
 National Forests in Section 331F: RG = Rio Grande–eastern part, SI = San Isabel–southern part.

The National Forests in these Sections that occur in New Mexico have not been included in this analysis as yet.

** The name of the Research Natural Area is followed by the abbreviation for its National Forest; its status: pr = proposed in Plan Revision DEIS,
 es = established; the degree of representation of the Plant Association in the RNA: M = major, m = minor.

*** Shading indicates the known occurrence of a Series on a National Forest.

**** RNAs found in Section 331F are indicated by shading

***** RNAs are listed under Series they contain, if Plant Association data is not available.

XX Series which probably occur on National Forests but are not substantiated by Plant Association data.

SERIES	PLANT ASSOCIATIONS AND COMMUNITY TYPES	NATIONAL FOREST *				RESEARCH NATURAL AREA **	
		GU	SI	RG	SJ		
UPLAND SERIES							
PONDEROSA PINE SERIES							
Ponderosa Pine	Pipo/Feid (<i>Festuca idahoensis</i>)	O					
	Pipo/Arad (<i>Arctostaphylos adenotricha</i>)		O				
	Pipo/Bogr (<i>Bouteloua gracilis</i>)			O			
	Pipo/Scsc (<i>Schizachyrium scoparium</i>)			O	O		
	Pipo/Fear1 (<i>Festuca arizonica</i>)	O	O	O		Hot Creek – RG – pr – M	
	Pipo/Pied–Quuga (<i>Pinus edulis</i> – <i>Quercus gambelii</i>)			O			
	Pipo/Quuga (<i>Quercus gambelii</i>)	O	O	O		Narraguinnep – SJ – es – M	
	Pipo–JUNI/Bogr (<i>Juniperus sp.</i> / <i>Bouteloua gracilis</i>)			O			
	Pipo–Psme/Mumo1 (<i>Pseudotsuga menziesii</i> / <i>Muhlenbergia montana</i>)	O?	O	O		Hot Creek – RG – pr – M	
DOUGLAS–FIR SERIES							
Douglas–fir	Psme/Arad–Juco (<i>Pseudotsuga menziesii</i> / / <i>Arctostaphylos adenotricha</i> – <i>Juniperus communis</i>)	O	O	O	O	North Zapata – RG – pr – M **** Mill Creek – RG – pr – m ? Deadman Creek – RG – pr – m	
	Psme/Cemo (<i>Cercocarpus montanus</i>)		O	O			
	Psme/Fear1 (<i>Festuca arizonica</i>)		O	O	O	Spring Branch – RG – pr – m	
	Psme/Jaam (<i>Jamesia americana</i>)	O					
	Psme/Putr (<i>Purshia tridentata</i>)	O					
	Psme/Quuga (<i>Quercus gambelii</i>)		O	O	O		

SERIES	PLANT ASSOCIATIONS AND COMMUNITY TYPES	GU	SI	RG	SJ	RESEARCH NATURAL AREA
Douglas-fir	Psme/Feid (<i>Festuca idahoensis</i>)	O				
	Psme/Syor1 (<i>Symphoricarpos oreophilus</i>)	O				
BLUE SPRUCE SERIES						
Blue Spruce	Pipu-Psme/Arad (<i>Picea pungens</i> – – <i>Pseudotsuga menziesii</i> / <i>Arctostaphylos adenotricha</i>)			O		
	Pipu-Psme/Caf1 (<i>Carex foenea</i>)				O	
	Pipu-Psme/Erex (<i>Erigeron eximius</i>)		O	O		
	Pipu-Psme/Fear1 (<i>Festuca arizonica</i>)	O	O	O		
	Pipu-Psme/Libo (<i>Linnaea borealis</i>)			O	O	
	Pipu/POA (<i>Poa spp.</i>)		O	O	O	
WHITE FIR SERIES						
White Fir	Abco-Psme/Arad (<i>Abies concolor</i> – <i>Pseudotsuga menziesii</i> / <i>Arctostaphylos adenotricha</i>)		O			Hot Creek – RG – pr – m
	Abco-Psme/Acg1 (<i>Acer glabrum</i>)	O	O	O		Hot Creek – RG – pr – m Williams Creek – SJ – es – m
	Abco-Psme/Erex (<i>Erigeron eximius</i>)			O		Williams Creek – SJ – es – M
	Abco-Psme/Fear1 (<i>Festuca arizonica</i>)		O			
	Abco-Psme/Hodu (<i>Holodiscus dumosus</i>)		O			
	Abco-Psme/Quga (<i>Quercus gambelii</i>)			O		
	Abco-Psme/sparse (sparse understory)	O	O	O		
	Abco-Psme/Syor1 (<i>Symphoricarpos oreophilus</i>)	O		O		
	Abco-Psme/Vamy (<i>Vaccinium myrtillus</i>)	O		O		
	Abco-Pifl/Fear1 (<i>Pinus flexilis</i> / <i>Festuca arizonica</i>)			O		
LODGEPOLE PINE SERIES		XX				
Lodgepole Pine	Pico/Arad (<i>Pinus contorta</i> / <i>Arctostaphylos adenotricha</i>)			O		
	Pico/Cage1 (<i>Carex geyeri</i>)	O				
	Pico/Juco (<i>Juniperus communis</i>)	O				
	Pico/Vamy (<i>Vaccinium myrtillus</i>)	O				
	Pico/Vasc (<i>Vaccinium scoparium</i>)	O				
LIMBER PINE SERIES						
Limber Pine	Pifl/Feth (<i>Pinus flexilis</i> / <i>Festuca thurberi</i>)	O				
	Pifl/Juco (<i>Juniperus communis</i>)	O	O	O		Mill Creek – RG – pr – m ?
BRISTLECONE PINE SERIES						
Bristlecone Pine	Piar/Fear1 (<i>Pinus aristata</i> / <i>Festuca arizonica</i>)	O	O	O		
	Piar/Feth (<i>Festuca thurberi</i>)	O	O	O		North Zapata – RG – pr – m Mill Creek – RG – pr – m ?
	Piar/Juco (<i>Juniperus communis</i>)	O				
	Piar/Rimo (<i>Ribes montigenum</i>)	O				

SERIES	PLANT ASSOCIATIONS AND COMMUNITY TYPES	GU	SI	RG	SJ	RESEARCH NATURAL AREA
ENGELMANN SPRUCE SERIES						
Engelmann Spruce	Pien1/Juco (<i>Picea engelmannii/Juniperus communis</i>)			O		Little Squaw Creek – RG – pr – M
	Pien1/moss (moss understory)	O	O	O	O	
	Pien1/Vasc (<i>Vaccinium scoparium</i>)				O	
	Pien1/Feth (<i>Festuca thurberi</i>)			O		Finger Mesa – RG – pr – m Little Squaw Creek – RG – pr – m
	Pien1/Vamy (<i>Vaccinium myrtillus</i>)		O	O		Finger Mesa – RG – pr – M Little Squaw Creek – RG – pr – M
SUBALPINE FIR SERIES						
Subalpine Fir	Abla/Cage1 (<i>Abies lasiocarpa/Carex geyeri</i>)				O	
	Abla–Pien/Arc02 (– <i>Picea engelmannii/Arnica cordifolia</i>)			O		Finger Mesa – RG – pr – M Little Squaw Creek – RG – pr – M
	Abla–Pien1/Juco (<i>Juniperus communis</i>)	O		O	O	
	Abla–Pien1/Libo (<i>Linnaea borealis</i>)		O	O	O	
	Abla–Pien1/moss (moss understory)	O		O	O	North Zapata – RG – pr – M Mill Creek – RG – pr – m ?
	Abla–Pien1/RIBE (<i>Ribes spp.</i>)	O	O?		O	
	Abla–Pien1/Sagi1 (<i>Salix glauca</i>)	O				
	Abla–Pien1/Vasc (<i>Vaccinium scoparium</i>)	O			O	Williams Creek – SJ – es – m
	Abla–Pien1/Erex (<i>Erigeron eximius</i>)		O	O	O	
	Abla–Pien1/Rupa (<i>Rubus parviflorus</i>)		O	O		
	Abla–Pien1/Vamy (<i>Vaccinium myrtillus</i>)	O	O	O	O	Mill Creek – RG – pr – m ? Deadman Creek – RG – pr – m Deadman Creek – RG – pr – M/m ? *****
ASPEN SERIES						
Aspen	Potr1/Cage1 (<i>Populus tremuloides/Carex geyeri</i>)	O			O	
	Potr1/Fear1 (<i>Festuca arizonica</i>)	O				
	Potr1/Feth (<i>Festuca thurberi</i>)	O		O		North Zapata – RG – pr – m
	Potr1/LIGU (<i>Ligusticum spp.</i>)	O	O		O	
	Potr1/Syor1 (<i>Symporicarpos oreophilus</i>)	O			O	
	Potr1/Thfe1 (<i>Thalictrum fendleri</i>)	O				
	Potr1/Vete (<i>Veratrum tenuipetalum</i>)				O	
JUNIPER AND PINYON SERIES						
Utah Juniper	Juos/Mafr (<i>Juniperus osteosperma/Mahonia fremontii</i>)	O				
	Juos/Orhy (<i>Oryzopsis hymenoides</i>)	O			O	
One-seeded Juniper	Juos–Pied/Rosp (<i>Pinus edulis/Roegneria spicata</i>)	O			O?	Narraguinnep – SJ – es – M ?
	Jumo/Bocu (<i>Juniperus monosperma/Bouteloua curtipendula</i>)	O				
Pinyon Pine	Jumo/Bogr (<i>Bouteloua gracilis</i>)	O	O			
	Pied/Bogr (<i>Pinus edulis/Bouteloua gracilis</i>)	O	O			North Zapata – RG – pr – m ? Spring Branch – RG – pr – m Mill Creek – RG – pr – M

SERIES	PLANT ASSOCIATIONS AND COMMUNITY TYPES	GU	SI	RG	SJ	RESEARCH NATURAL AREA
Pinyon Pine	Pied-Jumo/Cemo (<i>Juniperus monosperma/Cercocarpus montanus</i>)	O	O			North Zapata – RG – pr – m ?
	Pied/Quga (<i>Quercus gambelii</i>)			O		
	Pied/Stco (<i>Stipa comata</i>) [possible PA – not previously described]			O		Mill Creek – RG – pr – m
	Pied/Stsc (<i>Stipa scribnieri</i>) [possible PA – not previously described]			O		Mill Creek – RG – pr – M
	Pied-Juos/Artr (<i>Juniperus osteosperma/Artemesia tridentata</i>)	O		O		
ROCKY MOUNTAIN JUNIPER SERIES						
Rocky Mountain Juniper	Jusc/Quga (<i>Juniperus scopulorum/Quercus gambelii</i>) [possible PA – from 1980 baseline study]			O		Narraguinnep – SJ – es – m
MOUNTAIN MAHOGANY AND SKUNKBRUSH SERIES						
Mountain Mahogany	Cemo-Hodu (<i>Cercocarpus montanus/Holodiscus dumosus</i>) [possible PA – not previously described]			O		Mill Creek – RG – pr – m ?
	Cemo/Bogr (<i>Bouteloua gracilis</i>) [possible PA – not previously described]			O		Deadman Creek – RG – pr – m
Skunkbrush	Rhart/Mumo1 (<i>Rhus aromatica</i> spp. <i>trilobata/Muhlenbergia montana</i>)	O				
GAMBEL OAK SERIES						
Gambel Oak	Quga/Amal (<i>Quercus gambelii/Amelanchier alnifolia</i>)	O		O		
	Quga/Amut (<i>Amelanchier utahensis</i>)			O		Narraguinnep – SJ – es – M
	Quga/Cemo (<i>Cercocarpus montanus</i>)		O	O	O	Narraguinnep – SJ – es – m
	Quga/Syor1 (<i>Symporicarpos oreophilus</i>)	O		O		Narraguinnep – SJ – es – M
ROCK, SCREE, AND CLIFF VEGETATION SERIES						
Juniper-Currant	Juco-RIBE/Feth (<i>Juniperus communis/Ribes spp./Festuca thurberi</i>)	O				
Wax Currant	Rice/Feid (<i>Ribes cereum/Festuca idahoensis</i>)	O				
Senecio atratus	Seat/Phhe (<i>Senecio atratus/Phacelia heterophylla</i>)	O				
BIG SAGEBRUSH AND FOUR WINGED SALTBUSSH SERIES						
Big Sagebrush	Artr/Feid (<i>Artemesia tridentata/Festuca idahoensis</i>)	O				
	Artr/Feth (<i>Festuca thurberi</i>)	O				
Four Winged Saltbush	Atca/Stco (<i>Atriplex canescens/Stipa comata</i>)		O			North Zapata – RG – pr – m ?
IDAHO FESCUE SERIES						
Idaho Fescue	Feid/Eltr (<i>Festuca idahoensis/Elymus trachycaulus</i>)	O				
THURBER FESCUE SERIES						
Thurber Fescue	Feth/Dapa1 (<i>Festuca thurberi/Danthonia parryi</i>)	O	O?	O		Little Squaw Creek – RG – pr – m
	Feth/Fear1 (<i>Festuca arizonica</i>)	O	O	O	O	Finger Mesa – RG – pr – m Deadman Creek – RG – pr – M Williams Creek – SJ – es – m Little Squaw Creek – RG – pr – m
	Feth/Feid (<i>Festuca idahoensis</i>)	O				
PARRY OATGRASS, ARIZONA FESCUE, MUHLY, AND BLUE GRAMA SERIES						
Parry Oatgrass	Dapa1/Fear1 (<i>Danthonia parryi/Festuca arizonica</i>)	O				
	Dapa1/Feid (<i>Festuca idahoensis</i>)	O				
Arizona Fescue	Fear1/Mumo1 (<i>Festuca arizonica/Muhlenbergia montana</i>)	O	O	O		Spring Branch – RG – pr – M

SERIES	PLANT ASSOCIATIONS AND COMMUNITY TYPES	GU	SI	RG	SJ	RESEARCH NATURAL AREA
Slimstem Muhly	Mufi1/Arfr1 (<i>Muhlenbergia filiculmis/Artemisia frigida</i>)			O		
Mountain Muhly	Mumo1/Fear1 (<i>Muhlenbergia montana/Festuca arizonica</i>)	O	O?	O		North Zapata – RG – pr – m
	Mumo1/Mela (<i>Mertensia lanceolata</i>)	O				
Blue grama	Bogr/Atca (<i>Bouteloua gracilis/Atriplex canescens</i>)			O		Spring Branch – RG – pr – M
	Bogr/Mufi1 (<i>Muhlenbergia filiculmis</i>)			O		
WESTERN WHEATGRASS SERIES						
Western Wheatgrass	Elsm/Bogr (<i>Elytrigia {Pascopyrum} smithii/Bouteloua gracilis</i>)			O		Spring Branch – RG – pr – M
TIMBER OATGRASS SERIES						
Timber Oatgrass	Dain/Dece (<i>Danthonia intermedia/Deschampsia cespitosa</i>)	O		O		Mill Creek – RG – pr – m ? Deadman Creek – RG – pr – M Little Squaw Creek – RG – pr – m
ALPINE GRASSLAND AND RIDGE SERIES						
Elynoides Sedge	Cael/OREO (<i>Carex elynoides/Oreoxis sp.</i>)	O				
	Cael/Trda (<i>Trifolium dasypodium</i>)	O		O		
Black Alpine Sedge	Cani/JUNC (<i>Carex nigricans/Juncus spp.</i>)	O		O		
Cliff Sedge	Casc2/Bivi (<i>Carex scopulorum/Bistorta vivipara</i>)	O				
	Casc2/Cale1 (<i>Caltha leptosepala</i>)	O		O		
Foenea Sedge	Cafo/Acro (<i>Carex foenea/Acomastylis rossii</i>)	O				
Arctic Poa	Poar2/Bivi (<i>Poa arctica/Bistorta vivipara</i>)	O				
Tufted Hairgrass	Dece/Acro (<i>Deschampsia cespitosa/Acomastylis rossii</i>)	O	O?	O		Little Squaw Creek – RG – pr – m
	Dece/Judr (<i>Juncus drummondii</i>)	O				
Kobresia	Komy/Acro-Caru (<i>Kobresia myosuroides/Acomastylis rossii – Carex rupestris</i>)	O	O	O	O	North Zapata – RG – pr – m ? Finger Mesa – RG – pr – M Little Squaw Creek – RG – pr – m
	Komy/Trna (<i>Trifolium nanum</i>)				O	
	Komy/Pofe (<i>Poa fendleriana</i>) [possible PA – previously undescribed]			O		North Zapata – RG – pr – M Mill Creek – RG – pr – m ?
	Kosi/Bivi (<i>Kobresia sibirica/Bistorta vivipara</i>)	O				
Golden Avens	Acro/Bibi2 (<i>Acomastylis rossii/Bistorta bistortoides</i>)	O	O?	O		
	Acro/Poar2 (<i>Poa arctica</i>)				O	
	Acro/TRIF – Dece (<i>Trifolium sp.–Deschampsia cespitosa</i>)				O	
Marsh-Marigold	Cale1/Cirh (<i>Caltha leptosepala/Clematis rhodantha</i>)	O		O		
Alpine Parsley	Orba/Saar – Sede (<i>Oreoxis bakeri/Salix arctica – Selaginella densa</i>)			O		
Sibbaldia	Sipr/Libi – moss (<i>Sibbaldia procumbens/Lidia biflora – moss</i>)	O				
Sky Pilot	Povi/Erpi (<i>Polemonium viscosum/Erigeron pinnatisectus</i>)	O				
Snow Willow	Saren/Acro (<i>Salix reticulata spp. nivalis/Acomastylis rossii</i>)	O				
Arctic Willow	Saar/Trpa (<i>Salix arctica/Trifolium parryi</i>)	O				
Barrenground Willow	Sabr/Vace (<i>Salix brachycarpa/Vaccinium cespitosum</i>) [possible PA – previously undescribed]			O		Finger Mesa – RG – pr – m
Parry Clover	Trpa/Dece (<i>Trifolium parryi/Deschampsia cespitosa</i>)	O		O		

SERIES	PLANT ASSOCIATIONS AND COMMUNITY TYPES	GU	SI	RG	SJ	RESEARCH NATURAL AREA
ALPINE FELLFIELD SERIES		XX	XX			
Curly Sedge	Caru/Libi (<i>Carex rupestris/Lidia biflora</i>)	O				
Mountain Dryad	Droc/Caru (<i>Dryas octopetala/Carex rupestris</i>)	O				
Drummond Rush	Judr/Sipr (<i>Juncus drummondii/Sibbaldia procumbens</i>)	O				
Smelowskia	Smca/Arbo (<i>Smelowskia calycina/Artemisia borealis</i>)	O				
Whiproot Clover	Trda/Libi (<i>Trifolium dasypodium/Lidia biflora</i>)	O				
Dwarf Clover	Trna/Libi (<i>Trifolium nanum/Lidia biflora</i>)	O				
Parry Clover	Trpa/Acro (<i>Trifolium parryi/Acomastylis rossii</i>)	O		O		

WETLAND AND RIPARIAN SERIES		GU	SI	RG	SJ	RESEARCH NATURAL AREA
BLUE SPRUCE SERIES						
Blue Spruce	Pipu/Alint (<i>Picea pungens/Alnus incana spp. tenuifolia</i>)		O			Hot Creek – RG – pr – M
	Pipu/Amal–Swse (<i>Amelanchier alnifolia–Swida sericea</i>)	O		O		Escalante Creek – GU – es – m
	Pipu/Arco2 (<i>Amica cordifolia</i>)	O				Escalante Creek – GU – es – m
SUBALPINE FIR SERIES						
Subalpine Fir	Abla–Pien1/Caca (<i>Abies lasiocarpa–Picea engelmannii/Calamagrostis canadensis</i>)	O	O			Little Squaw Creek – RG – pr – m
	Abla–Pien1/Meci (<i>Picea engelmannii/Mertensia ciliata</i>)		O	O		
	Abla–Pien1/Setr (<i>Picea engelmannii/Senecio triangularis</i>)	O				
NARROWLEAF COTTONWOOD SERIES						
Narrowleaf Cottonwood	Poan3/Alint–Swse (<i>Populus angustifolia/Alnus incana spp. tenuifolia–Swida sericea</i>)	O	O			North Zapata – RG – pr – m ?
	Poan3–Pien1/Diin (<i>Picea engelmannii/Distegia involucrata</i>)		O	O		Mill Creek – RG – pr – m ?
THINLEAF ALDER SERIES						
Thinleaf Alder	Alint/Swse (<i>Alnus incana spp. tenuifolia/Swida sericea</i>)	O	O			Hot Creek – RG – pr – M
DOGWOOD AND ASPEN SERIES						
Red-osier Dogwood	Swse/Riin (<i>Swida sericea/Ribes inerme</i>)	O	O			Hot Creek – RG – pr – m
Aspen	Potr/SALIX/Mesic graminoid (<i>Populus tremuloides/Salix spp./Mesic graminoid [possible PA – not previously described]</i>)		O			Deadman Creek – RG – pr – m ?
MONTANE WILLOW SERIES		XX	XX	XX		
Drummond Willow	Sadr/Caca (<i>Salix drummondiana/Calamagrostis canadensis</i>)	O				
Geyer Willow	Sage–SALI/Caca (<i>Salix geyeriana–Salix spp./Calamagrostis canadensis</i>)	O				
SUBALPINE WILLOW AND BIRCH SERIES						
Grayleaf Willow	Sagl1–Sab1/Dece (<i>Salix glauca–Salix brachycarpa/Deschampsia cespitosa</i>)	O	O	O		Little Squaw Creek – RG – pr – M
Planeleaf Willow	Saphp/Caaq (<i>Salix phylicifolia spp. planifolia/Carex aquatilis</i>)	O	O?			
	Saphp/Casc2 (<i>Carex scopulorum</i>)	O		O		

SERIES	PLANT ASSOCIATIONS AND COMMUNITY TYPES	GU	SI	RG	SJ	RESEARCH NATURAL AREA
Planeleaf Willow	Saphp/Dece (<i>Deschampsia cespitosa</i>)	O	O			Finger Mesa – RG – pr – m Little Squaw Creek – RG – pr – m
Bog Birch	Begl/Casc2 (<i>Betula glandulosa/Carex scopulorum</i>)	O				
TUFTED HAIRGRASS, REEDGRASS, RUSH AND SEDGE SERIES						
Bluejoint Reedgrass	Caca–Casc2/Meci (<i>Calamagrostis canadensis–Carex scopulorum/Mertensia ciliata</i>)	O				
Reedgrass	Caca – Mesic forb [possible PA – not previously described]			O		Deadman Creek – RG – pr – m ?
Tufted Hairgrass	Capu/Pogl (<i>Calamagrostis purpurascens/Poa glauca</i>)	O				
Water Sedge	Dece/Cale1 (<i>Deschampsia cespitosa/Caltha leptosepala</i>)	O	O	O		Finger Mesa – RG – pr – m Little Squaw Creek – RG – pr – m
Common Spikesedge	Dece/Eltr (<i>Elymus trachycaulus</i>)	O				
Drummond Rush	Caaq/Caut (<i>Carex aquatilis/Carex utriculata</i>)	O	O			Finger Mesa – RG – pr – m
	Caaq/Caho1 (<i>Carex hoodii</i>)	O				
	Caaq/Pegr1 (<i>Pedicularis groenlandica</i>)	O	O			Little Squaw Creek – RG – pr – m
	Elpa/CARE (<i>Eleocharis palustris/Carex spp.</i>)				O	
	Judr/CARE (<i>Juncus drummondii/Carex spp.</i>)			O		

Plant Associations and community types are taken from Johnston, B. 1987. Plant Associations of Region Two. Edition 4. Rocky Mountain Region, R2–ECOL–87–2. Some potential Plant Associations identified during ecological evaluations of potential RNAs are also listed. As this matrix appendix indicates, current knowledge of plant associations and community types on some National Forests is incomplete.

USDA FOREST SERVICE, ROCKY MOUNTAIN REGION

NORTH-CENTRAL HIGHLANDS AND ROCKY MOUNTAIN SECTION, M331H **ECOREGIONS AND SUBREGIONS OF THE UNITED STATES** **R.G. BAILEY, ET AL. 1994.**

Because there are only two proposed RNAs and one established RNA in Section M331H, the full matrix of Plant Associations and community types for these National Forests is not displayed, as it was for Sections M331I and M331F. This matrix will be completed when other Forests in addition to the Routt have completed RNA analysis and/or proposed new RNAs in the Draft EIS for their Forest Plan Revisions.

PLANT ASSOCIATIONS AND COMMUNITY TYPES IN ESTABLISHED AND PROPOSED RESEARCH NATURAL AREAS

Section M331H includes the following National Forests:

Medicine Bow - western part	Routt - western part
White River - western part	Grand Mesa - all
Gunnison - northern part	San Isabel - western part

Plant Associations and community types known to occur on the three proposed and established RNAs on these National Forests are shown below:

Silver Creek proposed RNA - Routt National Forest

Subalpine Fir-Engelmann Spruce Series

Abla-Pien1/Cage (Abies lasiocarpa-Picea engelmannii/Carex geyeri)
Abla-Pien1/Vamy (Abies lasiocarpa-Picea engelmannii/Vaccinium myrtillus)
Abla-Pien1/Vasc (Abies lasiocarpa-Picea engelmannii/Vaccinium scoparium)
Most of the area occupied by the above Plant Associations has lodgepole pine (*Pinus contorta*) as the dominant overstory tree. The lodgepole pine is successional to an understory of spruce and fir.
Abla-Pien1/Setr (Abies lasiocarpa-Picea engelmannii/Senecio triangularis)

Engelmann Spruce Series

Pien1/Vace (Picea engelmannii/Vaccinium cespitosum)

Planeleaf Willow Series

Saphp/Caaq (Salix phylicifolia spp. planifolia/Carex aquatilis)

Mad Creek proposed RNA - Routt National Forest

Subalpine Fir-Engelmann Spruce Series

Abla-Pien1/Cage (*Abies lasiocarpa*-*Picea engelmannii*/*Carex geyeri*)
Abla-Pien1/Vamy (*Abies lasiocarpa*-*Picea engelmannii*/*Vaccinium myrtillus*)
Abla-Pien1/Vasc (*Abies lasiocarpa*-*Picea engelmannii*/*Vaccinium scoparium*)
Abla-Pien1/Sipr (*Abies lasiocarpa*-*Picea engelmannii*/*Sibbaldia procumbens*)
Abla-Pien1/mesic forb (*Abies lasiocarpa*-*Picea engelmannii*/mesic forb)

Aspen Series

Potr1/Ptaq (*Populus tremuloides*/*Pteridium aquilinum*)
Potr1/LIGU (*Populus tremuloides*/*Ligusticum* spp.)
Potr1/Thef1 (*Populus tremuloides*/*Thalictrum fendleri*)

Alpine Sagebrush Series

Arsc/Acro-Ivgo (*Artemisia scopulorum*/*Acomastylis rossii*-*Ivesia gordonii*)

Water Sedge Series

Caaq-Caut (*Carex aquatilis*-*Carex utriculata*)
Caaq-Pegr (*Carex aquatilis*-*Pedicularis groenlandica*)

Tufted Hairgrass Series

Dece-Cale (*Deschampsia cespitosa*-*Caltha leptosepala*)

Gothic RNA - Gunnison National Forest - established in 1959

Subalpine Fir-Engelmann Spruce Series

Abla-Pien1/Vamy (*Abies lasiocarpa*-*Picea engelmannii*/*Vaccinium myrtillus*)
Abla-Pien1/Setr (*Abies lasiocarpa*-*Picea engelmannii*/*Senecio triangularis*)

Alpine Series

Alpine Plant Associations - undescribed.

Subalpine Grassland Series

Subalpine grassland Plant Associations - undescribed.

[Baseline plant community data was not obtained when this RNA was established.]

RESEARCH APPENDIX

UPPER PINE CREEK RESEARCH NATURAL AREA Black Hills National Forest

Research in the Upper Pine Creek Research Natural Area is part of a forest-wide study of the Black Hills of South Dakota and Wyoming called the Blackgaps Project led by John Lundquist of the Rocky Mountain Experiment Station. The Blackgaps Project, in turn, is one part of a westwide network of studies with the following objectives: 1) to examine how small-scale disturbances (e.g., diseases, insects, fire, wind, etc.) disrupt ecosystem patterns and processes; 2) to link these disturbances to wildlife activity, biodiversity, scenic values, forest health, timber production, and other forest resources; 3) to develop landscape and community scale and multiple disturbance agent models to predict impacts from various disturbance combinations (including tree harvesting) on various forest resources; and 4) to examine how the derived information can be used in the forest planning process.

Since 1992, twenty 4-ha plots have been established in a north/south transect of the length of the Black Hills. Four plots are located in the Upper Pine Creek RNA. Others are in the Black Elk Wildlife Preserve immediately surrounding the RNA. The rest are in previously harvested stands. Plots in the Upper Pine Creek and plots in previously unharvested stands have been used as reference.

Various studies of the influences of small-scale disturbances and tree harvesting on ecosystem patterns and processes have been studied using these plots. In one study (Lundquist 1995a), we examined how disturbance agents are coupled (Lundquist 1995a) and affected by tree harvesting. A qualitative model was developed to display these interactions. In a second study (Lundquist 1995b), we developed a multivariate metric called disturbance profile to help quantitatively compare and contrast the disturbance status of stands. A disturbance profile is a combination of spatial and non-spatial statistics based on canopy structure, causes and their interactions, snags, logs, and recolonizing vegetation. In a third study (Lundquist 1995c), we used multivariate statistical methods to compare and contrast disturbance profiles among forest stands. Overall, results of these tree studies indicate that: 1) intensity of management influences diversity of canopy structure; 2) intensity of management influences the diversity of disturbance pathways; 3) diversity of disturbance pathways influences the abundance and diversity of snags and coarse woody debris; and 4) heterogeneity of canopy density across a stand is significantly negatively correlated with number of disturbance pathways.

In addition, the Upper Pine Creek plots are part of three other on-going studies that address non-timber resources. Study 1: neotropical migratory birds have been surveyed within each plot since 1994. The data set is too small yet to draw any significant conclusions. Our data should, however, indicate if and what cutting practices and

small-scale disturbances affect the distribution, abundance, and diversity of these birds. Study 2: the impact of small-scale disturbances and tree cutting intensity on ground beetle distribution, composition, and abundance is being examined in another study that began in 1995. We hypothesize that ground beetles are good biological indicators of stand biodiversity, and may relate to stand health. Study 3: aerial photos of Upper Pine Creek are being used to develop a method of generating maps of stand disturbance using image processing techniques.

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Lundquist, J.E. 1995a. Pest interactions and canopy gaps in ponderosa pine in the Black Hills, South Dakota. *Forest Ecology and Management* Vol. 70 (in press)

Lundquist, J.E. 1995b. Disturbance profile - a measure of small-scale disturbance patterns in ponderosa pine stands. *Forest Ecology and Management* Vol. 70 (in press)

Lundquist, J.E. 1995c. Characterizing disturbance in managed ponderosa pine stands in the Black Hills. *Forest Ecology and Management* Vol 70 (in press).

MT. GOLIATH RESEARCH NATURAL AREA Arapaho and Roosevelt National Forests

This RNA was designated because of its ancient bristlecone pine forest and has been the subject of bristlecone pine studies and other floristic inventories in the past. Recently, Anna Schoettle of the Rocky Mountain Experiment Station has used the Mt. Goliath RNA as a site for her study of needle retention in bristlecone pine as an indicator of stress.

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Schoettle, A.W. 1993. Comparison of shoot, needle, and physiological characteristics of erect and dwarf Bristlecone pine (*Pinus aristata*) trees at treeline. *Bulletin of the Ecological Society of America*, 74: 429.

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MARTINEZ CREEK POTENTIAL RESEARCH NATURAL AREA

San Juan National Forest

The focus of much of the research on Martinez Creek is directed toward understanding how small-scale disturbance phenomena influence stand development. The old-growth Engelmann spruce-subalpine fir forest of the Martinez Creek area has not had a large-scale disturbance for many years, and this offers a great opportunity for understanding how small biotic and abiotic disturbances create and maintain the complex structure of the stand.

Research on Martinez Creek was initiated as a joint project between Merrill Kaufmann from the Experiment Station and Bill Romme from Fort Lewis College. In addition, the following scientists participated in this research: Wayne Shepperd, Brian Geils, Jose Negron, Ross Watkins, Bob Obedzinski, and Steve Mata from the Experiment Station and Page Lindsey and others from Fort Lewis College. Field work was conducted over a several-month period, most of it in a couple of weeks. At one time we had about 15 people in the field.

First, a 100-m grid was laid out and marked with PVC stakes. This grid was used to map the forest stand over an area of about 900 x 1200 m, or about 1 km². Mapping included determining the habitat type and recording the location and probable year of death of standing snags, as well as coarse woody debris. A floristic list was begun, and at periodic intervals a survey of fungi was conducted along the grid lines.

Second, an intensive crown gap analysis was done for a 4-ha plot that involved stem and gap mapping, and a field analysis was done to determine the cause of death for trees that created gaps in the canopy. This was complemented with a similar plot several km west of Martinez Creek in a previously harvested stand.

Third, 10 Engelmann spruce and 5 subalpine (corkbark) fir trees that had died and were down but still sound were sampled to determine both their age at time of death and their annual volume growth increment using stem analysis techniques.

And fourth, a chronology was established for the site using old pine trees on a dry ridge. In addition, trees were sampled on the grid system to estimate the age structure of the stand, and fire scar samples were collected where available (near the ridges) to determine fire frequency.

Few of these data have been completely analyzed, but it is hoped that support will be available for the FY96 field season to collect additional data for characterizing the system and understanding the patch dynamics of spruce-fir forests.

ASHENFELDER BASIN PROPOSED RESEARCH NATURAL AREA

Medicine Bow National Forest

During early visits to the Ashenfelder Basin in the Laramie Mountains, researchers from the Rocky Mountain Experiment Station, Brian Geils and John Lundquist, observed the multi-size structure of ponderosa pines and the heterogeneous patch structure of the forest. As part of their regional study of the effects of bark beetle outbreaks on patch dynamics and disturbance processes, they selected the Ashenfelder Basin for two, one kilometer long, transects that document size-canopy structure and recent bark beetle history. The area was subsequently visited by Brian Geils, Jose Negron, Peter Brown, and Judy von Ahlenfeldt to determine possible future research opportunities and look at the interaction of fire ecology and bark beetle outbreaks in a model system that had been little influenced by humans.

Areas surrounding the Ashenfelder Basin were effected by a large historically unique outbreak of bark beetles, partially because of the uniform structure and particular age classes of the trees. Conversely, the heterogenous nature of the Ashenfelder Basin stands are hypothesized to have contributed to the patchiness of response to this outbreak. The Ashenfelder Basin was recognized as a good laboratory for testing this hypothesis and investigating the effects of multiple disturbance agents on the structure of Front Range pine forests.

ANIMAS RIVER POTENTIAL RESEARCH NATURAL AREA

San Juan National Forest

A six kilometer reach of the Animas River in San Juan Mountains has been the subject of several years of investigation led by Bill Baker and Gillian Walford of the University of Wyoming. Because of high quality examples of riparian vegetation that have been minimally impacted by domestic livestock grazing, this part of the Animas River will receive further evaluation as a potential RNA. In this research, the effect of very active geomorphic processes, especially flood disturbances, on riparian vegetation was studied. Within the complex spatial mosaic of riparian vegetation, 67 contiguous patches were examined. Eight community types were derived from a new classification approach using both tree canopy size class data and understory cover data for shrub and herbaceous species. The Animas River is an ideal site for studying the disturbance processes that drive the dynamic structural changes of riparian communities.

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BOSTON PEAK FEN PROPOSED RESEARCH NATURAL AREA Arapaho and Roosevelt National Forests

This small wetland near the Laramie River has been the subject of both botanical and geological investigations. Jan McKee, as a graduate student at Colorado State University, did research on the vegetation structure and classification of the wetland communities of this fen. McKee's thesis has not been published yet. Because the fen contains unusual uranium-enriched peat and lake sediments up to 13 feet deep, it has been the subject of several geologic investigations by Douglas Owen and others of the U.S. Geological Survey.

WILLIAMS CREEK RESEARCH NATURAL AREA San Juan National Forest

The Williams Creek RNA is notable for its white-fir and mixed conifer forest. During the summer of 1995, this RNA will be the subject of a baseline study of vascular plants, bryophytes, lichens, and fungi, as well as birds, other vertebrates and insects. Collections and voucher specimens will be made for plants and insects. The work is being conducted independently by Dr. Charles King and Richard Moseley, Jr.

HOT CREEK PROPOSED RESEARCH NATURAL AREA Rio Grande National Forest and NORTH ST. VRAIN PROPOSED RESEARCH NATURAL AREA Arapaho and Roosevelt National Forests

During the summer of 1994, Phil Robertson from Southern Illinois University selected these two proposed RNA sites for sampling of old-growth ponderosa pine forests because of the high quality old-growth they contain. This research is directed toward obtaining a

structural characterization of ponderosa pine old-growth within the central and southern Rockies.

BOWEN GULCH PROPOSED RESEARCH NATURAL AREA

Arapaho and Roosevelt National Forest

The Bowen Gulch area contains one of largest stands of old-growth Engelmann spruce-subalpine fir forest in Colorado. This area was one of several sites used in the study of the structural dynamics of spruce-fir forests by Rebertus and colleagues. The development of old-growth spruce-fir forests in Colorado was found to be highly variable and dependent on disturbance history and site conditions.

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